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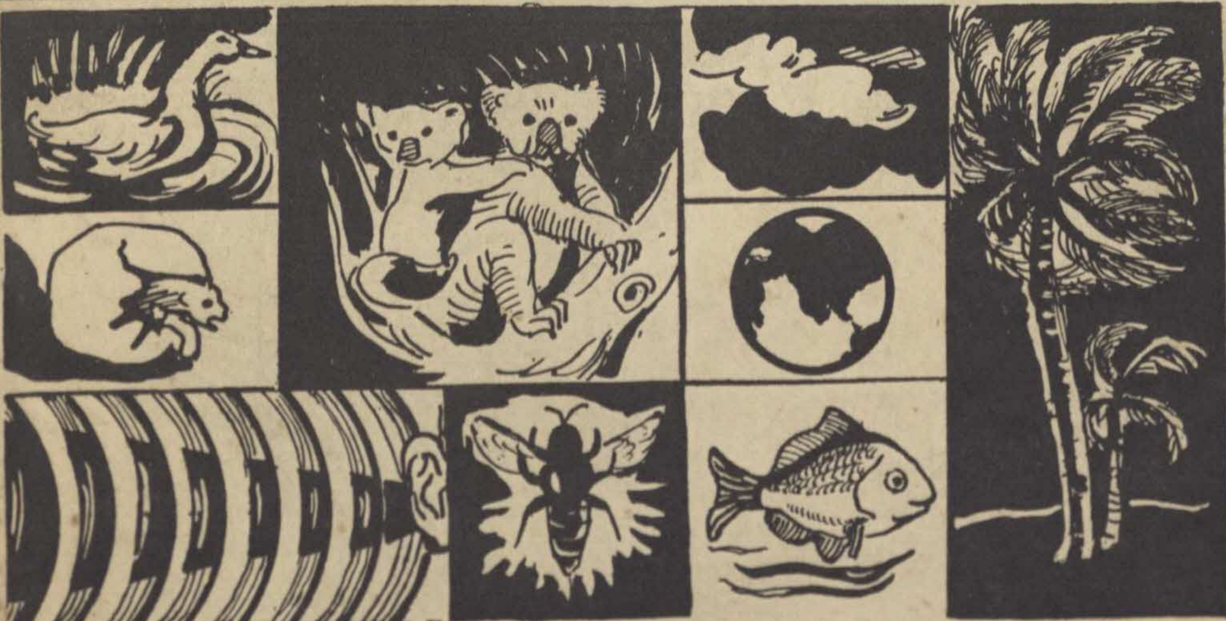
GENERAL SCIENCE

FOR PRIMARY SCHOOLS



NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

INSTITUTE OF EDUCATION FOR WOMEN
Dept. of Extension
SERVICE.
CALCUTTA-27

GENERAL SCIENCE

FOR PRIMARY SCHOOLS

BOOK TWO

INSTITUTE OF EDUCATION FOR WOMEN
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Contents

1. Life Around Us 1
2. How Green Plants Make Food 4
3. Grass Plants 10
4. How Animals Get Their Food 15
5. How Animals Protect Themselves 20
6. How Animals Reproduce 28
7. Animals Live Together 34
8. Air and Weather 44
9. Water and Weather 53
10. Water under the Ground 63
11. Water above the Ground 71
12. Making Dirty Water Clean 77
13. Water and Living Things 83
14. How Your Food is Prepared 89
15. How Your Cloth is Made 94
16. Your Nerves 101

17. *Your Teeth* 106

18. *What are Germs ?* 112

19. *Our Earth* 117

20. *The Earth's Special Star* 122

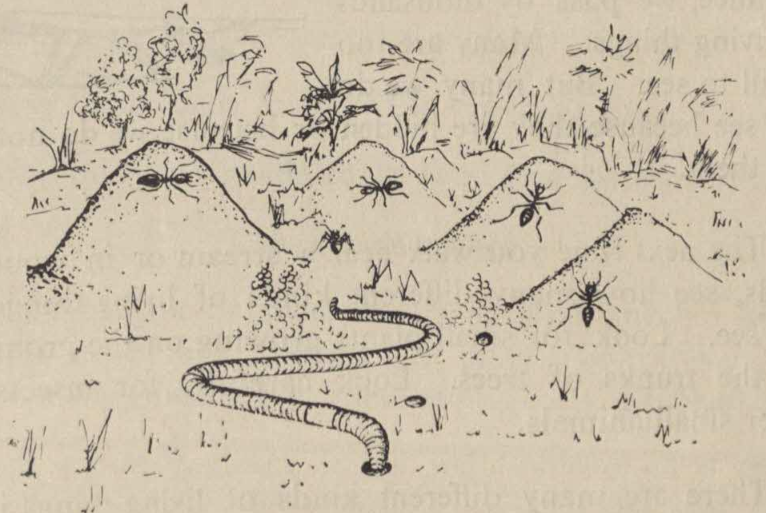
21. *How Seasons Change* 125

22. *The Soil* 131

23. *The Big Pull of the Earth* 135

24. *How Heat Helps You* 142

25. *How Tools Help You* 147



1. *Life Around Us*

How many animals can you name that are less than a centimetre long ? How many plants can you name that are more than 10 metres high ? How many animals can you name that have wings ? Have hooves ? Have horns ? Swim in the water ? Live under the ground ?

How many plants can you name that have wooden trunks for stems ? Have nuts for fruits ? Have yellow flowers ? Live in water ? Live in shady places ? We could ask many, many other questions, and what would all our questions show ?

They would show how many different kinds of living things there are.

When we walk through woods or fields for even a short distance, we pass by thousands of living things. Many are too small to see. But many we do not see because they are hidden or because we do not look for them.

The next time you walk near a stream or in woods or fields, see how many different kinds of living things you can see. Look for small plants growing on the ground or on the trunks of trees. Look carefully for insects and other small animals.

There are many different kinds of living things in the world. Have you ever wondered why ? All living things must find food to live, and there are many different kinds of food. Green plants use energy from sunlight to make their own food. Bees use nectar and pollen; mosquitoes suck plant juices and blood; elephants eat grass; sharks eat fish; snakes and owls eat mice; mice eat grain. Think of all the different kinds of foods living things use. What a different world it would be if all living things ate only wheat !

Living things are built to eat different kinds of food. An animal sucking blood needs parts that are different from an animal cracking seeds or chewing grass. When you study an animal or plant, a good question to ask yourself is this : "how does it get food ?" You can learn a lot about a living thing as you answer this question. You will find that animals and plants are wonderfully made to get the kind of food they need.

What did you learn ?

There are many different kinds of plants and animals.

Living things must find food in order to live.

Living things are made to get food in a variety of ways.

Things to do at home

1. Place a blanket or sheet on the ground under a leafy shrub or branch. Shake the plant vigorously. See how many animals fall from the plant on the blanket.
2. Look carefully at the leaves and branches of a small tree and shrub. How many animals can you find living on them ?
3. Look carefully for mushrooms and moulds growing on food. Mushrooms and moulds are also plants. Write a report on where you found them.
4. Make a list of plants you find growing in shady places.
5. Make drawings showing different animals and the foods they eat. Show how each animal is specially made to eat its kinds of food.

2. *How Green Plants Make Food*

Plants and animals are alike in some very important ways. They grow and reproduce. They need food, water and air to live. But green plants can do one thing which no animal can do. They can make their own food by using sunlight, air, water and minerals in the soil.

For a long time people thought that plants made food out of soil. Plants do use water and minerals from the soil, but they also use a lot of air in making their food. This may seem very strange to you. It took many years to discover this fact. Actually the plants use only a small part of the air for making food. They use a gas called carbon dioxide which is present in the air.

Green plants are able to use the energy of sunlight to combine carbon dioxide and water to make food. This does not sound difficult to do but only green plants can do it. Many scientists are working to understand how they do it.

Look at the picture on page 4. It shows you the parts of a plant and tells you how each part helps the whole plant to live. How much do you remember from last year ?

The food is made in the leaf. Some food is made in stems, but leaves are the chief food makers of the plant. Let us see how a leaf is specially made to do this job.

Do this

1. Stand under a tree that is covered with leaves and look up at the sky through its branches. How much light comes through ? Are the leaves in a good position to catch sunlight ?
2. Pick a leaf from the tree and study it carefully. What is its shape ? Is the shape a good one for catching a lot of air ?
3. Study the lines on the leaf. These lines are really little tubes. They are called *veins*. They spread water and minerals through the leaf and take away the food that is prepared by it to other parts of the plant. Make a careful drawing of the veins in your leaf.

Different kinds of leaves

Most leaves are broad and flat to catch sunlight and carbon dioxide, leaves of this shape are good for making food, but they are also dangerous when the plants are not able to take in much water through their roots. A lot of water evaporates from large, flat leaves. Without water a plant dies. In places where the ground freezes and water is scarce, trees with large leaves usually shed their leaves, so that they will not lose too much water. They grow new leaves when it becomes warm again.

Pines and some other trees have leaves in the shape of needles. Not much water is lost from these needle leaves and the pines keep their leaves even in cold weather.

Why leaves are green

Have you ever wondered why grass and the leaves of so many other plants are green ? They are made green by a wonderful substance called *chlorophyll.* Using chlorophyll, plants are able to change the energy from sunlight into food energy. Without chlorophyll they would starve and so would we and all other animals.

What did you learn ?

Only green plants can make their own food.

Green plants use sunlight, carbon dioxide, water and minerals to make their food.

The broad, flat shapes of most leaves help them catch sunlight and carbon dioxide.

The veins of leaves spread water and minerals throughout the leaf and carry the prepared food to other parts of the plant.

Some leaves are needle-shaped so that the tree will not lose much water.

Plants use chlorophyll to turn the energy from sunlight into food energy.

Things to do at home

1. Grow 18 bean or pea seedlings. Start 12 of them in complete darkness and keep them without light. Compare their growth with the six seedlings grown in light. After a week of growth, move six of the seedlings from the dark to the light. Watch them turn green as the plants start making chlorophyll. Leave the remaining six seedlings in the dark and watch what happens to them as they use up the food stored in the seed.

2. Place two young plants of similar size and shape in the sunlight. Stop giving them water. Remove most of the leaves from one plant. Observe the two plants to see which wilts first.

3. Observe the spacing of leaves on a tree. Do many leaves grow in the shade ? Do you notice any difference

between leaves growing in bright sunlight and those growing in the shade ?

Questions to answer

1. Choose the word or words in Column B that fit the phrases in Column A.

A	B
a) substances used by green plants to make food	1. carbon dioxide
b) sources of energy used by green plants to make food	2. water
c) substances carried in the veins of leaves	3. minerals
d) substances entering the plant through the roots	4. sunlight
e) substances entering the plant through the leaves	
f) substances leaving the plants through the leaves	

2. Fill in the blanks with suitable words.

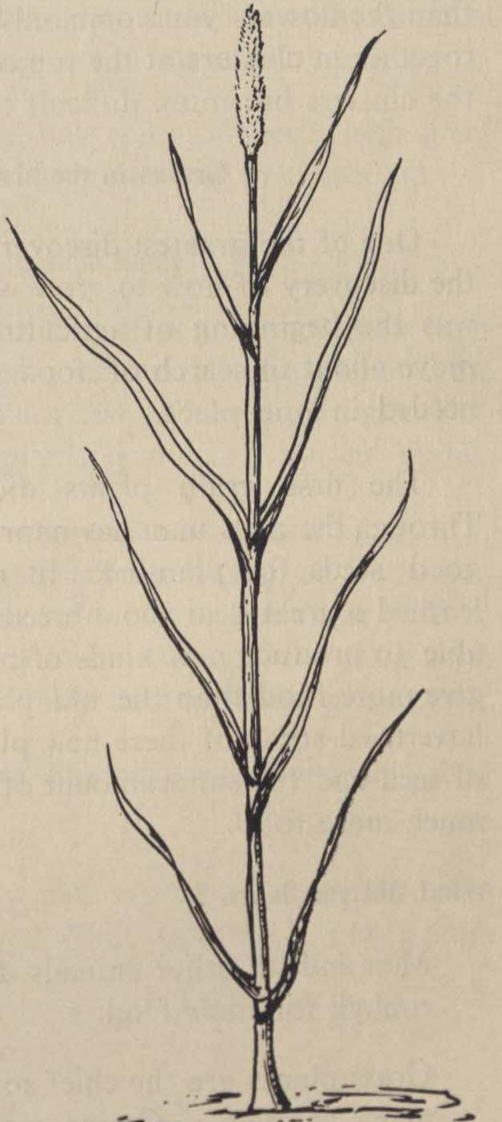
a) Plants need the green substance............. in order to use............. as energy for building food.

b) Broad, flat leaves are sometimes dangerous for plants because much............. evaporates from their surface.

3. *Grass Plants*

All animals and plants depend on sunlight to give them the energy for living. But man and other animals cannot use the energy of sunlight to make food. We can stand in sunlight and be warmed by it, but only plants with chlorophyll can use energy from sunlight to make food. Man and all other animals depend on green plants for their food.

The chief source of food for man and many kinds of animals are the grass plants. People usually eat only the seeds of the grass but in many parts of the world they also eat animals that have been fed on grass. Cows, buffaloes and other animals eat grass and produce milk which we can drink. Hens eat the seeds of grass and produce eggs, another important food.



The pictures on page 10 show some of the different kinds of grass seeds people eat. We call them grains or cereals. Wheat has been grown by farmers for more than 5,000 years. Rice is an important food for more people in the world than any other cereal.

Man uses grass plants in other ways also. The stems of sugarcane have been used for a long time as a source of sugar. In addition to eating the shoots of young bamboo, he uses the stems in making houses, furniture, baskets, mats and other things.

Parts of a grass plant

Study the picture of

the grass plant. You will find that grass plants have the the same parts as many other plants. They have roots, stems, leaves and flowers. The flowers are much smaller than the flowers you commonly know. They are grouped together in clusters at the top of the plant. It is easy to see the clusters but more difficult to see the individual flowers.

Grains in the history of man

One of the greatest discoveries ever made by man was the discovery of how to grow wheat and other grains. This was the beginning of agriculture. Man no longer had to move about in search of food. He could grow what he needed in one place.

The first grain plants did not produce much food. Through the ages man has improved the plants by choosing good seeds for planting. In recent years scientists have learned a great deal about breeding plants. They have been able to produce new kinds of plants that are healthier and give more food than the old plants. Perhaps your parents have tried some of these new plants. For the same amount of seed and the same amount of work they are able to grow much more food.

What did you learn ?

Men and all other animals depend on plants with chlorophyll for their food.

Grass plants are the chief source of food for man and many animals. Grains are particularly important to man.

Grass plants have roots, stem, leaves and flowers. The flowers are very small and grow in clusters.

The discovery of how to grow grains is among the most important ones in the history of man.

Scientists have produced new types of seed which grow into healthier plants giving more food than the old.

Things to do at home

1. Bring different grass plants to class and compare their parts. Be careful, when you remove the plants from the ground, that you do not destroy too many roots. You may find some grass plants connected by an underground stem.
2. Dig up a piece of soil with grass growing on it. Plant the grass in a flat pan or some other container. Keep the soil damp but not too wet. Cut off the grass with scissors and watch how the stem and leaves grow again.
3. Make a collection of the different grasses grown in your locality.
4. Try to find out if any new types of seed have been planted in your locality. What were the results of the experiment ?

Questions to answer

Are the following statements correct ?
If not, correct them,

a) Grass plants have roots, stems and leaves but no flowers.

b) Grains are the seeds of grass plants.

c) All grass plants are less than four metres tall.

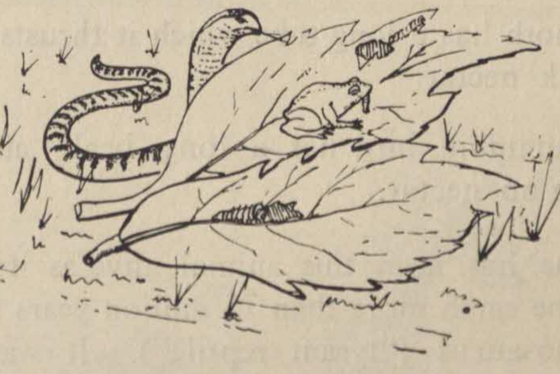
d) Scientists are able to help farmers grow better plants.

e) Grass plants are the chief source of food for man.

f) Man has been growing wheat for less than 3,000 years.

4. *How Animals Get Their Food*

As animals are not able to make their own food, they must find it already made for them. Many animals eat the green plants directly and these we call *herbivorous* animals. Other animals are not built to eat plants. They must feed on other animals and these meat-eaters we call *carnivorous* animals.



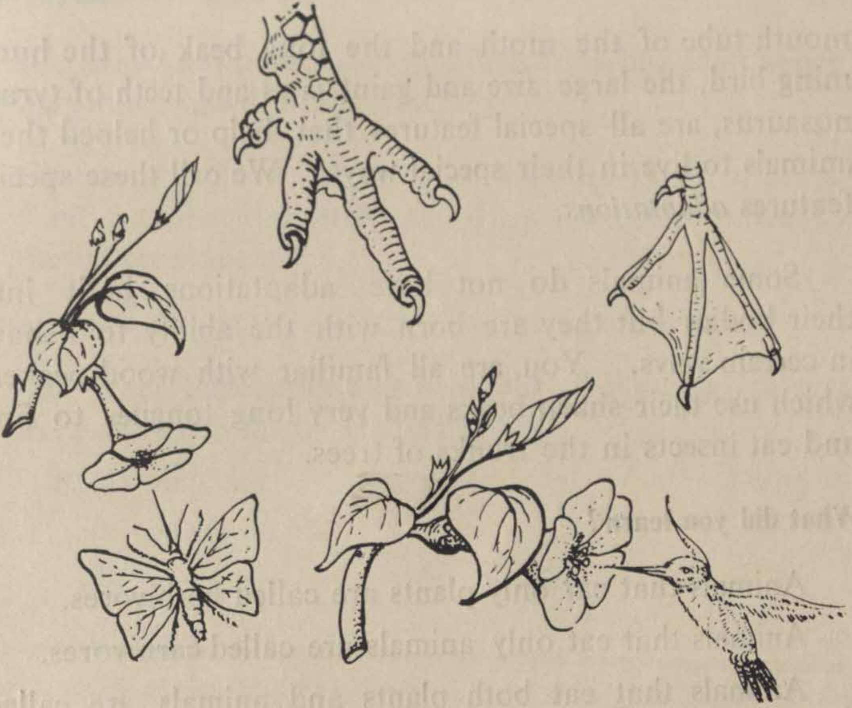
Look at this picture of a scene in the forest. A beetle has been eating the leaves. A frog has just seized the beetle and a snake is about to capture and eat the frog. Which of the animals in this scene is the herbivore? Which are the carnivores?

Most insects, mice, deer, elephants and many other animals are herbivores. Snakes, many lizards, some insects, tigers, hawks and owls are examples of carnivores. In addition there are animals, such as man, monkey, crow and cockroach, that eat both plants and animals. These are known as *omnivores*.

Let us see how good a detective you are. Study each of the pictures on the next page and decide what kind of food you think each animal eats.
Here are the answers.

1. The foot of an eagle is built to catch animals.
2. The foot of a duck is so built that the duckcan swim about and eat food from the bottom of lakes and ponds.
3. The moth has a long tube which it thrusts into flowers to drink nectar.
4. The humming bird has a long beak, also used for sucking up nectar.
5. No one has seen this animal alive as it disappeared from the earth more than 75 million years ago. It is a Tyrannosaurus ("tyrant reptile"). It was 14 metres long and 5½ metres tall when standing. Its great jaws were filled with large, sabre-like teeth. Therefore, scientists believe that it must have been a carnivore. Do you agree ?

You can study many other animals to see how they are specially built to eat certain kinds of food. The sharp claws of the eagle, the webbed feet of the duck, the long



mouth tube of the moth and the long beak of the humming bird, the large size and gaint jaws and teeth of tyrannosaurus, are all special features that help or helped these animals to live in their special ways. We call these special features *adaptations.*

Some animals do not have adaptations built into their bodies but they are born with the ability to behave in certain ways. You are all familiar with wood-peckers which use their sharp beaks and very long tongues to find and eat insects in the trunks of trees.

What did you learn?

Animals that eat only plants are called herbivores.

Animals that eat only animals are called carnivores.

Animals that eat both plants and animals are called omnivores.

Animals have special parts and special ways of behaving to fit them for their different ways of living.

These special parts and special ways of behaving are called adaptations.

Things to do

1. The picture of the forest scene showed a snake about to eat a frog that was eating a beetle that had been eating leaves. We can write in it this way : snake—frog—beetle—leaves. This is called a food chain. Try to write five other food chains.

2. Watch animals around your home or observe them in

the fields or woods. Can you discover what adaptations help them find food successfully ?

3. Observe and draw the beaks of different kinds of birds. Find out what the birds eat. How are beaks suited to the different diets ?

Questions to answer

1. Tell what adaptations each of the following animals have that help them get their food.
   - (a) elephant
   - (b) cobra
   - (c) owl
   - (d) frog
   - (e) monkey

2. Tell whether each of the following would be food for a carnivore or a herbivore.
   - (a) carrots
   - (b) tadpoles
   - (c) nectar
   - (d) blood
   - (e) wood

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5. How Animals Protect Themselves

Green leaves are adapted to catch sunlight and carbon dioxide and to use these to make food. Animals are adapted to find food in many ways. But finding food is not the only problem living things have. Let us study some of the other problems animals must solve to live successfully.

Even as most animals look for food, they must remember that some other animal may be looking for them. In the forest scene shown in the last lesson the frog had found a beetle for a meal but he in turn was about to become a meal for the snake. Animals must have ways of escaping from their enemies.

Do this

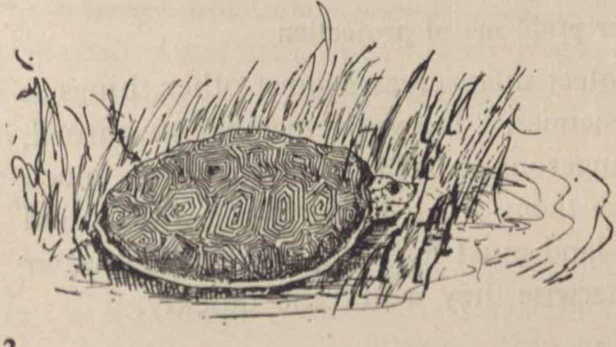
Study each of the pictures on the next page and decide what adaptations each animal has for protecting itself against enemies.

The deer in the first picture depends mostly on speed to escape his enemies. He has a keen sense of smell to warn him of the approach of an enemy so that he can start running in time. If forced to stand and fight he will use his horns and hooves.

The turtle can give a mean bite but you have probably all seen a turtle put his head and legs inside his shell when he is scared. His shell is his chief protection.

The crayfish has a strong, muscular tail that he uses in swimming backwards quickly. He likes to dart backwards under a rock and face his enemies with his large claws.

1



2

3

4

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6

The next two animals you know well. The rabbit can run very fast to reach the safety of his burrow and the wasp flies quickly but can sting as well. The colour of the wasp also helps to protect him, if once you are stung by wasps you learn to leave animals of this colour alone. Did you know that some insects have taken advantage of this fact? They do not have a sting but they look like wasps and therefore are left alone.

The last picture shows a famous Indian butterfly that is used in books all over the world to show how clever some animals are in looking like their surroundings. Can you imagine trying to find one of these butterflies among the leaves? Some insects are also hard to find, particularly the walking stick insect that looks so much like a stick.

Other problems of protection

Animals must protect themselves against other things as well as against their enemies. Do you remember how broad, flat leaves can be dangerous to plants because so much water evaporates from them? All living things, plants and animals, that live on land must have ways of keeping water in their bodies. Otherwise they would die quickly.

Have you ever picked up a frog? His skin feels somewhat wet and slippery becaues it is covered with mucus. Mucus helps reduce the amount of water that evaporates from the frog's skin. Even so the frog must return to a pond or lake frequently because it will dry out quickly and die if it remains on land.

Snakes, lizards, birds, cows, dogs and such other animals, all have dry skins that do not let water escape. They live successfully on land all the time. You know that some water does escape your skin when you sweat but this is under the control of your body. The water a frog loses is not under its control.

All insects have their skeletons on the outside of their bodies. Sometimes the skeleton is very thin, as in a mosquito, but it is always there. This skeleton is quite waterproof and keeps insects from loosing too much water. Do you remember that sometimes adaptations are ways of behaving ? Scientists have studied some small flies and discovered that whenever they are tired, they always rest in the shade. They never rest in bright sunlight. This habit helps them save water.

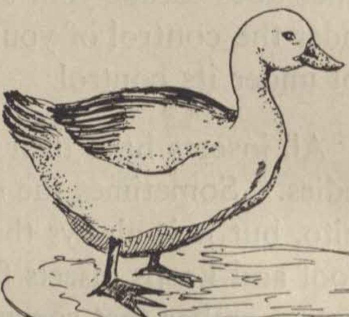
Animals must also protect themselves against too much heat, too much cold, too much wind, too much snow. They must protect themselves against all sorts of harmful weather.

Do this

Study each of the pictures on the next page and decide how each animal protects itself against harmful weather.

The animals shown in pictures 1, 2 and 6 on page 24 have a very special way of protecting themselves against harmful temperatures. All birds and mammals are able to keep their bodies warm. Mammals are animals which grow hair. Most mammal babies are born alive. Dog, cat, cow, rat, elephant, rabbit are some examples of mammals. The temperatures of other animals change as the temperatures of their surroundings change.

1



2

3

4

5

6

Bears have a heavy coat of fur but they also seek shelter in caves if the weather becomes too harsh. Birds are kept warm by feathers and many, such as the geese shown here, make long flights to escape bad weather. Mice have fur and seek shelter in burrows. Moths make cocoons to live through cold periods as pupas. Many insects live underground during cold months. The wasps in the next picture are building a paper case for the protection of their young. And the last picture shows you a very clever living thing who has many ways of protecting himself against the weather. How many can you name ?

What did you learn ?

Animals have many adaptations to protect themselves from enemies.

Animals and plants living on land must have ways of keeping water in their bodies.

Snakes, lizards, birds and mammals, all have dry skins that do not let water escape.

Birds and mammals are able to keep their bodies warm.

The temperatures of all other animals change as the temperatures of their surroundings change.

Things to do at home

1. Watch the birds and squirrels around your home. How do they behave? Are they alert to the danger of enemies?
2. Look for insects on flowers, leaves and branches. Can

you find any that look very much like their surroundings ? If you do, try to bring them to school with the parts of the plants on which they were resting.

3. Can you find any brightly coloured insects ? Does their colour help to protect them in the way the wasp's colour protects the wasps ?

4. Observe the behaviour of ants or other insects on cold days and on warm days. Are they able to move as fast on cold days ?

5. How many types of animal shelters—nests, holes and the like, can you find around your home ?

6. Collect or draw pictures of animals that protect themselves in certain ways. For instance draw a group of different animals that depend upon speed for safety, a group that depends on poison for protection, and so on.

Questions to answer

1. Match the items in column A with the items in column B.

A	B
a) A wasp protects itself by	1. digging a burrow.
b) A crayfish protects itself by	2. being very small.
c) A rabbit protects itself by	3. being very large.

d) A flea protects itself by

e) An elephant protects itself by

f) A walking-stick insect protects itself by

4. stinging.
5. looking like its surroundings.
6. swimming backwards.

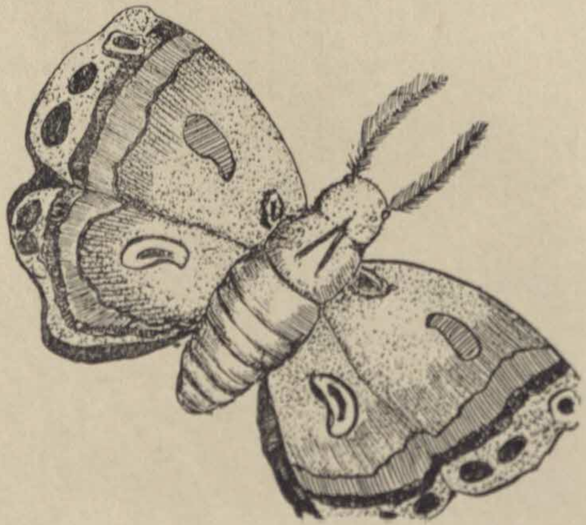
2. Bright colours that make an insect easily seen may help protect the insect. Tell why this is so.

3. Tell the different ways in which animals
   (a) protect themselves from losing too much water.
   (b) protect themselves from cold weather.

6. *How Animals Reproduce*

An animal does not need to have young ones in order to live. But animals reproduce and thus keep a supply of animals alive on this earth. Elephants produce new elephants, owls produce new owls, ants produce new ants. Otherwise, elephants, owls and ants would disappear completely. Animals have adaptations that help them reproduce successfully.

In most animals you know males and females come together to produce young ones. It may seem easy for male animals to find female animals, but this is not always so.



It may be difficult for fish to find each other in the depths of the ocean which are very large and dark. Moths may have difficulty in finding mates in the woods.

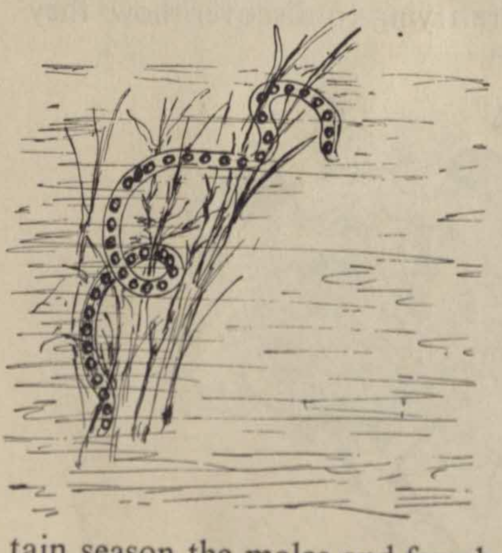
Have you ever examined the feelers of moths ? In the male they are very feathery and they are so sensitive that he can smell a female moth from miles away. When the female moth hatches from her cocoon she makes a chemical that attracts her kind of male from a long distance through the dark night. Her ability to make the chemical and his ability to smell it are both adaptations to help them produce new moths.

Other insects have different ways of finding each other. Listen quietly some evening for the sound of crickets. Or go out in the dark and look for insects such as fireflies that are able to glow. Fireflies are able to make a cold chemical light. Scientists are trying to discover how they

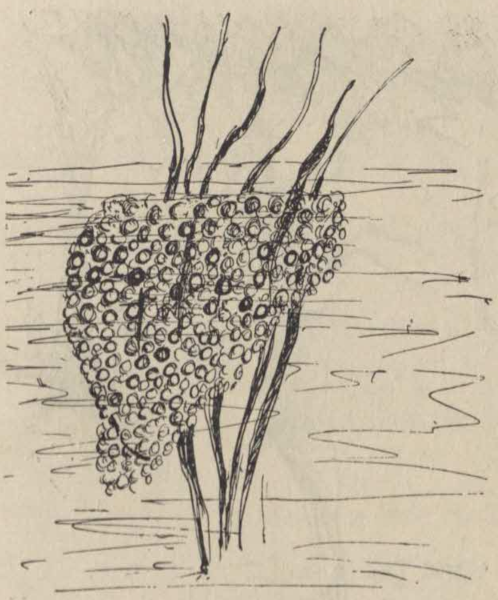
make such a light, for it would be useful to be able to make light without heat.

Animals raise their young in many different ways. Many animals take very good care of their young and help them to get started in life. Mammals carry their young inside them while the young begin growing. After they are born, the mothers feed them with milk. Did you ever think of milk as an adaptation ? Young herbivores learn to eat plants quickily but mothers of young carnivores must catch food for them and teach them how to hunt.

Most birds take good care of their young. They lay eggs filled with food which the young use as they grow within the shell. Eggs are adaptation too : Parent birds guard the eggs and keep them warm. When the young birds hatch, the parents feed and protect them.



Can you tell the kind of eggs shown in the picture on the left ? Have you ever seen such eggs in ponds ? These are the eggs of toads. They are found in strings. The eggs on the next page are the eggs of frogs. They are found in clumps. Toads spend most of their lives on land, but in a certain season the males and females come together in ponds to produce young. What do you think makes them come together? Do you think this way of behaving is an adaptation.



The toad eggs and frog eggs grow into tadpoles. What help do tadpoles receive from their parents ? They receive no help and so many die. Most fish and insects and many other kinds of animals are like frogs and toads. They do not care for their young. They lay many eggs so that at least a few will survive. Some fish lay millions of eggs. Scientists have discovered that the codfish living in the sea usually lays four million eggs a year.

Sometimes animals produce too many young. When this happens there is not enough food for all the new animals and many die. Look at the picture on page 32 of the deer standing on its hind legs. This is a hungry deer. Too many deers were born and all the good food has been eaten. This deer is stretching for a few leaves up in the tree.

What did you learn ?

Animals must reproduce their kind or they would disappear from the earth.

In most familiar animals males and females come together to produce young.

Some parents take good care of their young.

Some parents take no care of their young. They lay many eggs and only a few survive.

When too many young animals are produced, there may not be enough food for all.

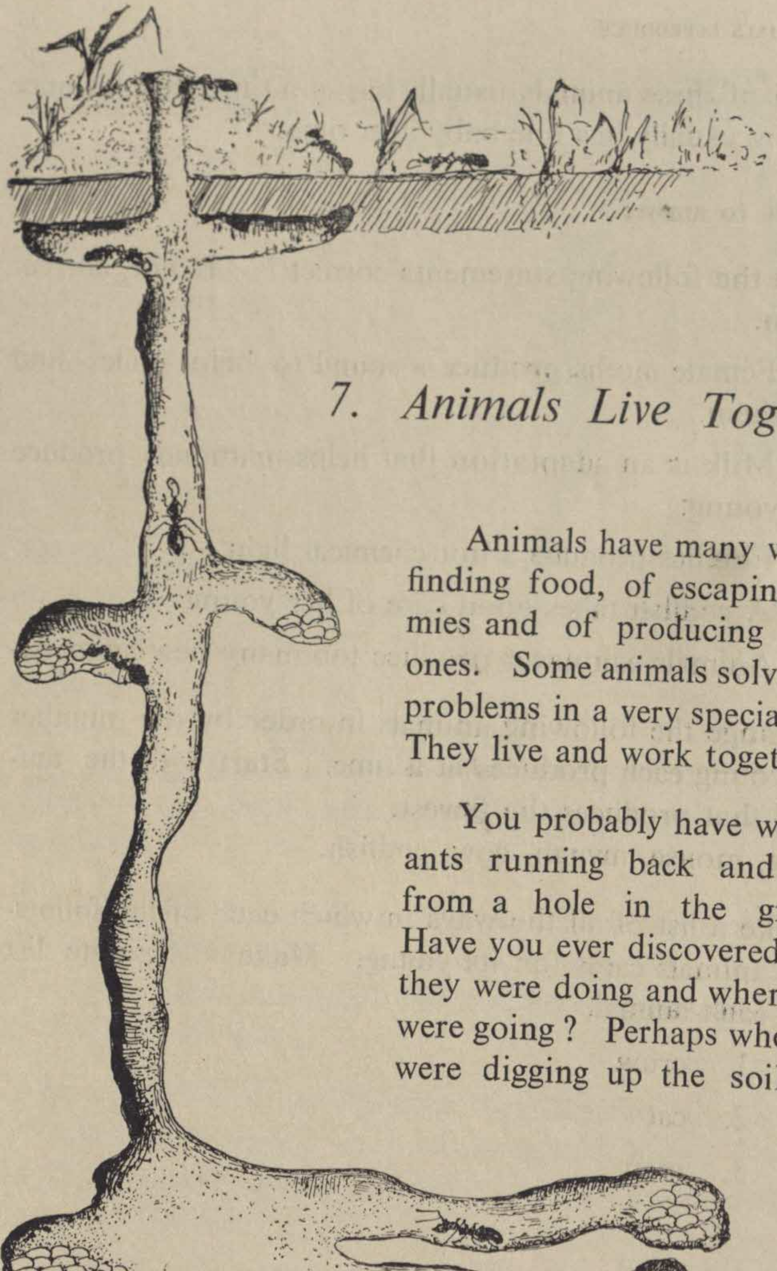
Things to do at home

1. Observe the birds and other animals in your neighbourhood.
2. If you find a nest with eggs or young birds in it, observe it as often as you can. Keep a record of what you see. Does the male help the female ? How hard do the parents work ?
3. Try to discover when the male and female toads come together in the ponds of your neighbourhood. Visit the ponds when they are there. Try to discover how many eggs one female lays.
4. Make a list of all the animals you know that take good care of their young. Find out how many young ones

each of these animals usually has at a time. For instance a cow usually has one baby at a time.

Questions to answer

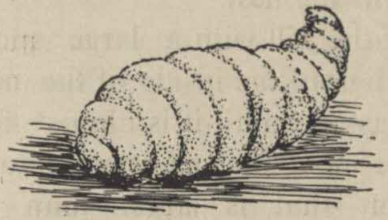
1. Are the following statements correct? If not, correct them.
   (a) Female moths produce a sound to help males find them.
   (b) Milk is an adaptation that helps mammals produce young.
   (c) Fireflies produce a hot chemical light.
   (d) A codfish takes good care of her young.
   (e) Animals can never produce too many new animals.
2. Arrange the following animals in order by the number of young each produces at a time. Start with the animal that produces the fewest.
   frog, mouse, mynah, cow, codfish.
3. Make a list of all the ways in which each of the following animals cares for its young. Make a separate list for each animal.
   1. crow
   2. cat
   3. man

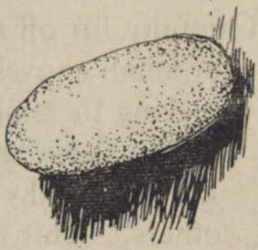


7. *Animals Live Together*

Animals have many ways of finding food, of escaping enemies and of producing young ones. Some animals solve these problems in a very special way. They live and work together.

You probably have watched ants running back and forth from a hole in the ground. Have you ever discovered what they were doing and where they were going? Perhaps when you were digging up the soil, you





broke into an ant's nest such as the one shown in the picture on this page. You could see some of the ants running about carrying small white objects. Do you know what these objects were ?

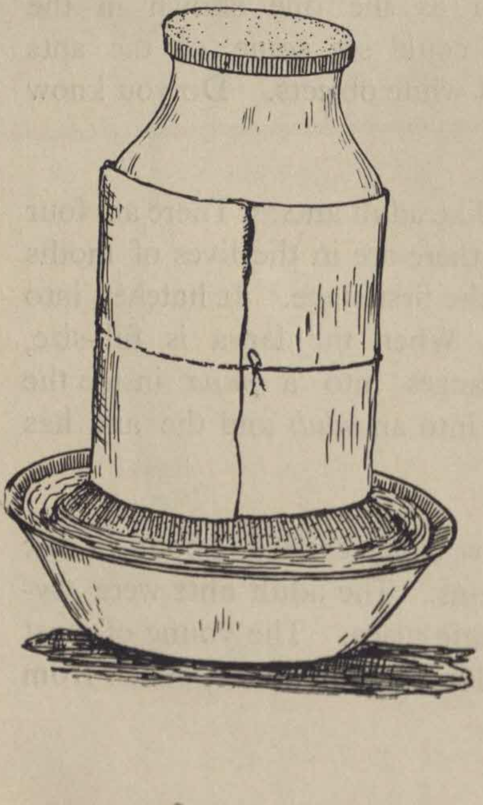
Young ants do not look like adult ants. There are four stages in the lives of ants as there are in the lives of moths and butterflies. The *egg* is the first stage. It hatches into a larva that eats and grows. When the larva is full-size, it makes a *cocoon* and changes into a *pupa* inside the cocoon. The pupa changes into an *adult* and the ant has finished growing.

The white objects you saw being carried about in the ant nest were probably cocoons. The adult ants were trying to carry them to a safe place. The young of most insects must care for themselves as soon as they hatch from eggs, but young ants are raised by adult ants in nurseries. The adult ants find food for the larvae and try to keep the larvae and cocoons warm and safe.

Do this

Take a large glass jar with a cover and search for an ant hill. It is best to do this in cool weather so that most of the ants will be in the nest.

Carefully lift off the top of the hill with a large spoon or small shovel. Then dig out the inside of the nest, placing the soil in the glass jar until it is almost full. Put in some larvae, some cocoons and some adults. Look carefully for an ant that is larger than the others. This is the queen. She is the only ant that can lay eggs.



When you return from your hunt, fix the jar as shown in the picture. Set the jar on a block of wood, a brick or stone in a pan of water. Then you can take off the cover and the ants will not be able to escape.

Wrap a heavy sheet of paper around the jar to keep it dark inside. After a few days you can take off the paper for a few minutes and observe what is taking place in your colony. Be certain to replace the paper. Otherwise the ants may stop using tunnels near the sides where you can watch them, for they do not like light.

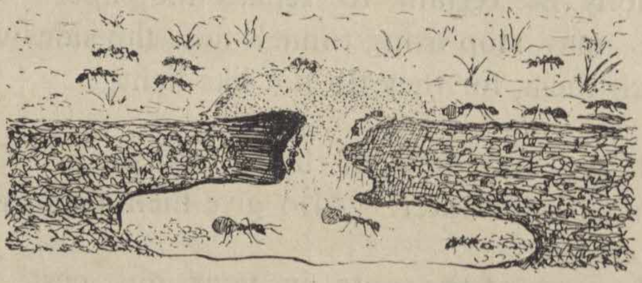
Feed the ants bits of bread and sugar. Give them honey mixed with water. Also give them dead insects.

Look at one of the ants in your ant nest. Can you find the head, thorax and abdomen? Can you see the ant's eyes and feelers? How many legs does it have and where are they attached?

Sometimes you will see ants with wings. These are the males and females that are able to reproduce. They fly high in the air on a mating flight. When they come back to earth they are usually far from where they started. In this way ants find new places to live.

The males soon die. The female bites off her wings and builds a nest alone. She lays eggs and takes care of the young until they become adults. In this way a new colony is started. She is a queen in the colony and the other adults are workers. The queen now spends the time laying more eggs. The workers care for the young, gather food and protect the colony.

Ants are the most successful insects in the world. This means that there are many many ants, they are found



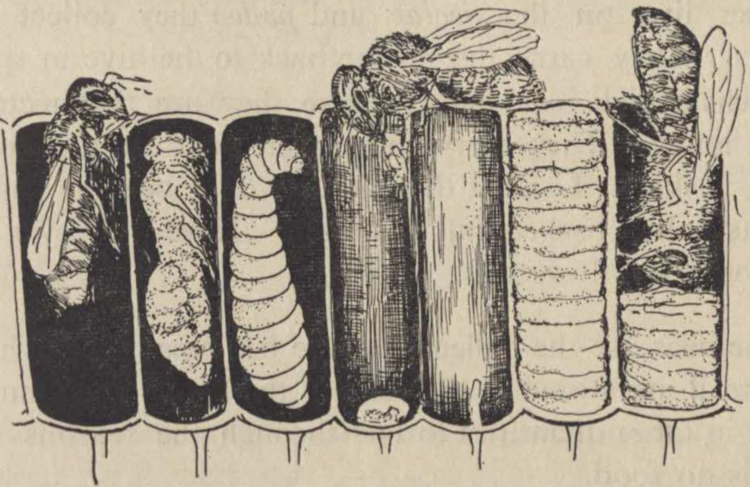
in many different places, and eat all sorts of food. Some ants are like shepherds. They take care of other small insects called aphids or plant lice. Aphids suck sap from plants and give off a juice that ants like. Other ants are like farmers. They collect leaves and bring them to their nests. Here they keep the leaves so that fungus grows on them. The ants eat the fungus. In the picture you see some ants bringing leaves to their nest. A piece of leaf usually weighs about five times as much as the ant.

Honey Bees

Ants are not the only animals that live together. Termites, wasps and bees are other familiar insects that share the work of getting food and raising young ones.

The picture on page 39 shows the four stages in a bee's life. The queen lays *eggs* in the wax cells of the hive. Each egg hatches into a *larva* which is fed by the worker bees. As soon as the larva has finished growing, it spins a cocoon round itself and changes into a *pupa*. Later the pupa changes into an *adult*.

The adults have many kinds of work to do. A few, a



very few, become *queens*. A queen does not rule a hive. Her job is to lay eggs. Some bees become males called *drones*. Their only job is to mate with the queen. Most bees become *workers*. They must collect food and feed the queen, the drones and the young. They must build the hive, keep it clean and protect it. Worker bees live very busy lives and work themselves to death in six weeks during the warm seasons.

Bees live on the *nectar* and *pollen* they collect from flowers. They carry the nectar back to the hive in special stomachs called *honey sacs*. Here they use the nectar to make honey. They carry the pollen back to the nest in pollen baskets. Look at the picture of a bee on page 39 with its pollen baskets full of pollen. Have you ever seen such bees on flowers ?

The bees use the pollen to make bee bread. The honey and bread are stored in the cells of the hive. They must be stored in large quantities to last through the seasons when there is no food.

Other animals that live together

In a penguin colony, some penguins guard the young while others search for food. Some animals, such as the buffalo, form herds for protection. But only one other animal forms a group like the ants and bees. Do you know what that animal is ? The answer is, man.

Human beings are very successful animals. Long ago they learned how to live together and to share their work. By cooperating they learned how to grow more food and to discover many useful things about the world.

What did you learn ?

Ants, bees, termites, wasps and human beings live together in special ways.

Ants and bees have four stages in their lives : egg, larva, pupa, adult.

Only queen ants and queen bees lay eggs.

Worker ants and worker bees care for the young and collect the food.

Ants are very successful insects. They eat many different kinds of food.

Bees use nectar and pollen as food.

Things to do

1. See how many different kinds of ants you can find in your neighbourhood. Can you discover where each kind makes its nest and what each uses for food ?
2. If you see ants climbing up a plant, look for aphids. If you are very quiet you may see ants stroking aphids with their feelers so that the aphids will give them some juice.
3. Watch the activities around an ant hill. Take careful note of what happens. If you ever disturb a hill, watch how the ants repair the damage.
4. Put a little bit of sugar or bread near an ant hill. How long does it take the ants to find it ? Do the ants seem to tell each other about the food ?
5. Try to find someone who keeps bees. Ask him to show you the hive and to point out the different kinds of bees.
6. Look for bees visiting flowers. Do they seem to be

visiting the same kind of flowers ? Try to follow one bee for a while. Can you find a bee with full pollen baskets ?

Questions for you

1. Each statement below is followed by five items. Pick the item or items that are correct.

   (a) Worker ants are able to

      1. feed the young.
      2. fly.
      3. lay eggs.
      4. start a new colony.
      5. protect the nest.

   (b) Queen bees spend most of their time

      1. bringing pollen to the hive.
      2. feeding the larva.
      3. laying eggs.
      4. living in the hive.
      5. making honey.

   (c) Bees and ant larvae

      1. hatch out of eggs.
      2. find their own food.
      3. spin cocoons.
      4. never leave the hive or nest.
      5. turn into adults.

2. Tell which ants and which bees do the following jobs:
   - (a) mate
   - (b) lay eggs
   - (c) protect the home
   - (d) find food

3. Do bees or ants go to school? How do young bees or ants know what to do? Tell how bees and ants living together are different from people living together.

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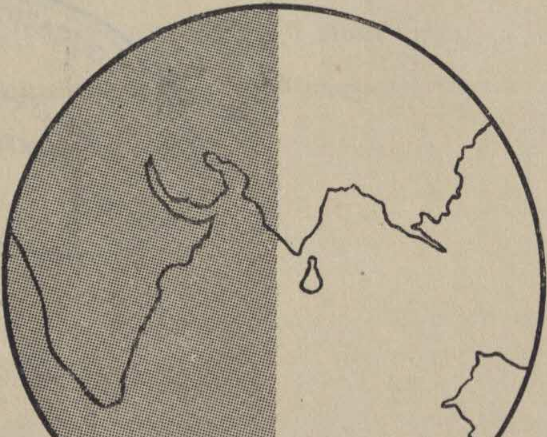
8. *Air and Weather*

What kind of weather are you having right now ? Is it cold or warm ? Is it raining ? Is it calm or windy ? The weather is very important to us and we talk about it a lot. Through the ages weather has always been important to man and he has struggled to understand it. Let us see what he has discovered.

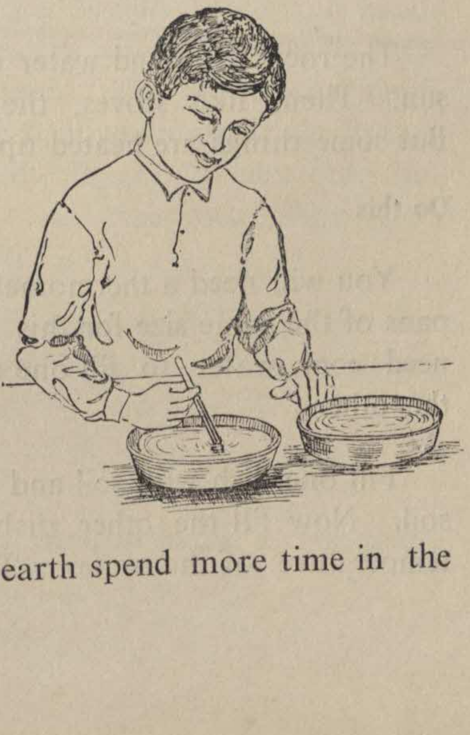


The sun plays the biggest part of all in making the changes in our weather. The sun is very hot and it heats the earth from very far away. You know that the earth is a huge ball that goes round the sun. When your part of the earth is in the sunlight, it is daytime and the sun warms things up. You and the land, water and air around you are all made warmer by the sun. When your part of the earth turns out of sunlight into darkness, night comes and everything begins to cool.

Your part of the earth turns into the sunlight every day but the weather is not the same every day. A bright sunny day in winter is not as warm as a bright sunny day in summer. What makes the difference?

Do this

You will need a thermometer and two flat dishes or pans for this experiment. You will also need some cool water to put in the dishes. Place one in the bright sunlight and the other in the shade. After ten minutes, place the dish that has been in the shade next to the dish in the sunlight. Now both the dishes are in bright sunlight. After a minute, quickly take the temperature of the water in each dish. What do you find?



When are days longer?
When does your part of the earth spend more time in the

sunlight ? In the winter or in the summer ? The time spent in sunlight makes a difference in the weather. The more time you spend in the sunlight the more time the sunlight warms you and everything around you. By nine o'clock on a summer morning the sun has been up a long time and you and the air around you are quite warm. By nine o'clock on a winter morning the sun has not been up so long and the air is still quite cool.

The sun warms the earth and the air around it. The temperature of the air is one important part of the weather. It is the part that interests us when we ask, "Is it hot or cold outside ?"

Winds and the weather

You know that winds are moving air. But what makes the air move ? Let us see.

The rocks, soil and water on earth are warmed by the sun. Then, like stoves, they warm the air above them. But some things are heated up more than others.

Do this

You will need a thermometer and two large dishes or pans of the same size for this experiment. You will also need cool water to fill one dish and cool, dry soil to fill the other.

Fill one dish with soil and find the temperature of the soil. Now fill the other dish with water and find the temperature of the water. The temperatures of the soil and the water should be the same. If necessary heat the water until it is as warm as the soil or find cooler water.

Now put both dishes in the sunlight and leave them for a few minutes. Stir the water and the soil about every two minutes. At the end of ten minutes find the temperatures of the soil and of the water. Which has warmed up more ?

Things that are heated most by the sun make the air near them warmest. In the day time the land warms up more quickly than the water. Then the air over the land becomes warmer than the air over the water. We have warm air in one place and cool air in another. When warm air meets cool air, something happens.

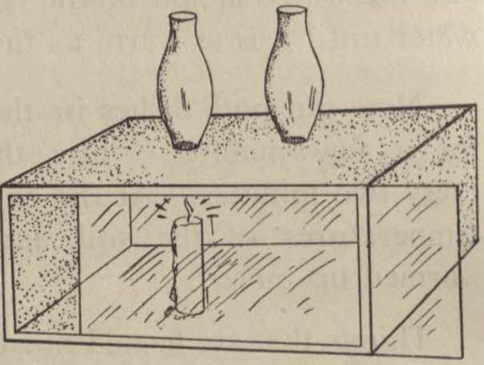
Do this

Light a candle and fix it to a stand. Hold your hand on one side of the flame. Does the air feel warm ? Feel the air on other sides of the flame. Now place your hand high above the flame and move it down towards the flame. How close can you come to the flame? Where does the air feel warmest ? What does this experiment show you about air that has been heated ?

Warm air rises. It is lighter than cold air. When air is heated it rises. Cool air moves in under the warm air to push it up.

Do this

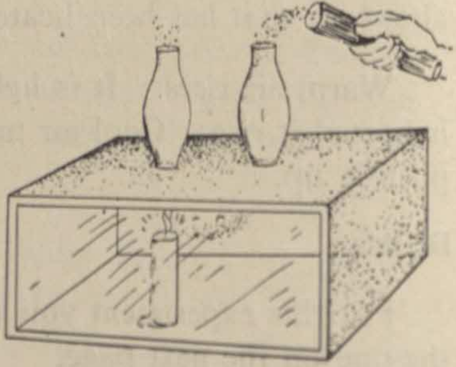
For this experiment you will need to make a box like the one on the next page.



Use a wood or cardboard box and find a piece of glass to use as a window. A wooden chalk box that has grooves for the cover works very well. Cut two holes from 2.5 to 3 cm in diameter. Place a lamp chimney over each hole. If you cannot find a lamp chimney, make tubes of paper about 15 cm long instead.

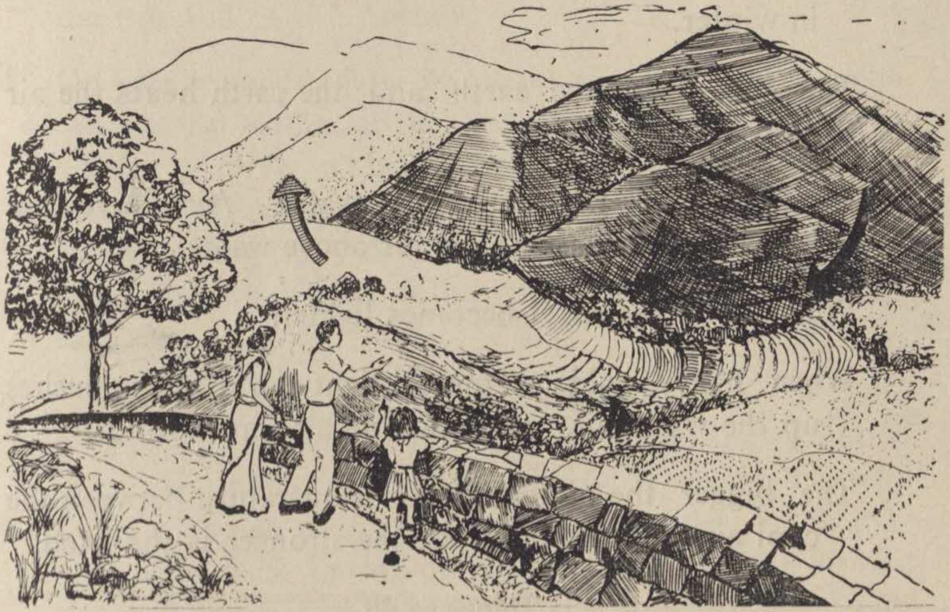
Place a candle under one chimney and light it. Close the glass front. Take a spill of paper that has been moistened slightly so that it will smoke as it burns.

Hold the smoking spill above the chimney that does not have the lighted candle under it. Follow the smoke around. The smoke shows you how the air is moving. Where is the air warm ? What is the warm air doing ? Where is the air cool ? What is the cool air doing ?



When warm air and cool air meet, the warm air is pushed up by the cool air. The warm air and cool air move from place to place. In this way winds are made.

Air over land is warmed faster than air over water. The warm air rises as the cool air over the water moves in under it. Cool air on the shady side of a mountain makes a wind as it moves down over a sunny valley and pushes up the warm air in the valley.



Sometimes the difference between the temperatures of the cool air and the warm air is small. Then the moving air forms gentle breezes. When the difference is large the air moves fast and makes strong winds.

The sun heats the earth more in some places than in others. The warm air and the cool air move from place to place. This movement of air is an important part of the weather. It is the part that interests us when we ask, "Is it windy today ?"

What did you learn ?

The sun plays a big part in changing weather. As the earth turns, the part in sunlight becomes warmer and the part in darkness becomes cooler.

Days are longer and therefore warmer in summer than in winter.

The sun heats the earth and the earth heats the air above it.

Land is made warm faster than water. Air above land is made warm faster than air above water.

When air is heated, it becomes lighter.

When heavy cold air meets light warm air, it pushes up the warm air. The moving air forms winds.

The bigger the difference in temperature between the cool air and the warm air, the stronger is the wind.

Things to do

1. Make a record of the temperatures in your neighbourhood over several days. Always take the temperatures at the same time and in the same place each day.
2. Read the newspapers to discover the temperatures in different parts of India.
3. Find out which day of the year is shortest and which day is longest, where you live.
4. Use a piece of smoking paper or an incense stick to trace air currents in different places. Open a door a few centimetres between a warm room and a cold room.

Explore the movement of air between the two rooms. Hold the paper at different heights. Explore the air currents in a room in which the windows are open at the top and at the bottom.

5. Do you remember how to make a wind vane ? You can place a feather at the end of a drinking straw or a piece of straw of similar size. Fasten the straw to the end of a stick using a pin. The straw should be able to swing freely in any direction around the pin. Using this wind vane, follow the direction of the wind each day.

6. Ask your parents or teacher to help you make a 'gubbara wali kandeel'. Make or buy a kite that is in the shape of a parachute. Below this build a light bamboo frame to which you can fasten a small clay pot. Put oil and a wick in the pot and light it. As the air becomes heated it will push the kite upwards. It will rise high in the sky.

Questions to answer

1. Fill in the blanks in the following sentences.
   (a) Winter days are———and cooler than summer days.
   (b) Warm air is———than cool air.
   (c) The sun warms up the land———than it does the water.
   (d) The bigger the difference in temperature between warm air and cool air, the———the wind will be.

(e) In the daytime air above water is———— than air above land.

2. A boy and a girl are standing on the edge of a large lake in the afternoon. They feel a breeze blowing in towards the shore from the lake. Explain what makes this breeze.

9. *Water and Weather*

You have learned how the sun heats the earth and the earth heats the air above it to make the days warm or cool, windy or calm. Water too plays a part in making the weather change.

Do you remember studying about water in the air ? You learned that little particles of water are in the air all the time even though we cannot see them. These very, very little particles of water are called *water vapour*. The sun heats the water in ponds, lakes, seas and streams and some water moves into the air to form water vapour. When water does this, we say it *evaporates*. This is what happens when clothes dry, puddles disappear and plants wilt. Water moves into the air to form water vapour.

This water vapour does not always remain in the air. As it comes out of the air it makes the weather change. Water vapour can come out of the air in different ways. Let us see what some of them are.

Dew

Warm air holds more water vapour than cold air. If we cool warm air, some of the water vapour comes out of the air. You have probably all blown your breath on a cold window pane. What happened ? Your breath was warm and it held a lot of water vapour. When the air of your breath struck the cold glass it was cooled and some of the water vapour collected as drops of water on the glass. When water vapour changes into drops of water we say it condenses.

Do this

You will need two tin cans or glass tumblers of the same size for this experiment.

Fill one can with ice and water. Fill the other can with warm water. Soon you will see a film of water on the outside of one can. Which can is it ? Has the water leaked through the can ? Where has the water come from ?

The water vapour in the air near the can was cooled and collected on the can as little drops of water. The water vapour condensed when it struck the can.

Water vapour that comes out of the air and forms drops on cold things is called *dew*. On clear nights things near the ground are often cooler than the air around them. In the morning we may find dew on these things. Leaves, grass, spider webs and other things all sparkle with dew.

What happens to the dew as the sun strikes it ? Where does the water go ? You should be able to answer this question.

Frost

On some nights the things near the ground become very cold. There temperature becomes lower than the freezing temperature of water. What do you think happens to the water vapour in the air when it strikes such cold objects? Will the water vapour form little drops of water or will it form fine pieces of ice ?

The water vapour that condenses on very cold objects is frozen. It forms *frost*. Have you ever seen frost on the fields on cold winter mornings ?

Clouds and fog

Water vapour does not always condense on objects we can see, such as plants and window panes. Sometimes it condenses on particles of dust and smoke in the air itself. If this happens near the ground we call it *fog*. If it happens in the sky we call it a *cloud*. Have you ever walked or driven through a cloud high in the mountains or flown through a cloud in a plane ? The cloud is made up of many, many tiny drops of water just as fog is.

What do you remember about clouds ? Do you remember studying how warm air becomes cool as it rises in the sky ? What will happen to the water vapour in the warm air as it rises ? It will condense on tiny particles of dust and smoke in the air. When there are many of these small drops of water together you will see a cloud.

Do this

You will need hot water, a piece of ice and a milk bottle for this experiment.

Fill the bottle with hot water and let it stand for a few minutes. Pour out most of the water, leaving about 2 cm in the bottom. Hold a piece of ice very near the opening of the bottle but do not block the opening. Look for the appearance of a cloud in the bottle.

You may also hold a burning straw in the bottle for a very short time just before holding the ice over the top. The smoke will give the water vapour more small particles on which to condense. But do not make too much smoke or you will not be able to see the cloud.

Can you tell how the cloud was formed ? Where did the water vapour come from ? What cooled the water vapour ? Where did the water vapour condense ?

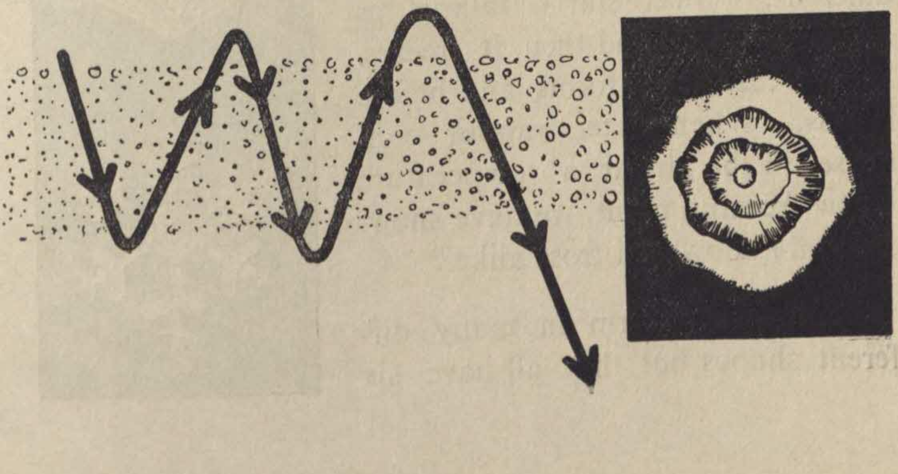
Clouds and the weather

Clouds make a big difference in our weather. They may block the sunlight, so it does not make the earth so warm. We have cooler weather.

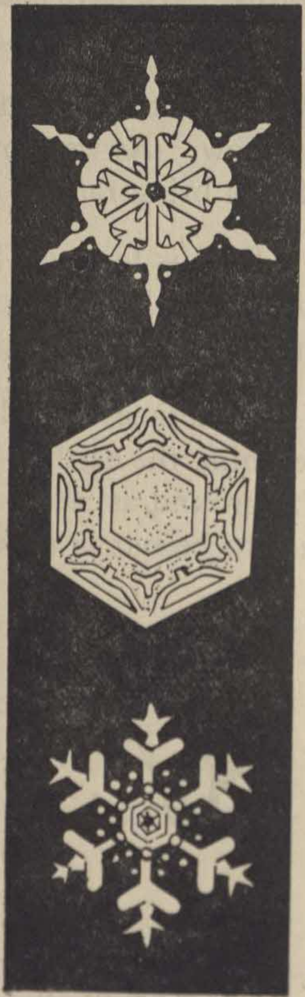
But clouds may make other changes in our weather. We look at them and wonder if they will bring rain or sleet or snow. As we grow older we learn to tell what kinds of clouds bring rain or other storms.

Rain is formed when the little drops of water in a cloud grow too large to stay up in the air. They fall to the ground as rain, sometimes gently, sometimes in a rush.

Sometimes raindrops fall through cold air before reaching the earth. They become frozen and beat against the ground as *sleet*. Sleet is frozen rain. It is not any fun to be out in a sleet storm.



Sometimes rain reaches the earth as pieces of ice much larger than the frozen raindrops of sleet. We call these larger pieces of ice *hailstones* and they are formed in a special way. Frozen drops of sleet falling towards the earth are suddenly carried up again by currents of rising air. They are swept back into clouds and here they are covered with a thin layer of water. Down they fall again. The new layer of water bocomes frozen. Up they go again and a new layer of water is added. Up and down the hailstones go until they become too heavy to be carried up any more. Then they come crashing down to earth when they may do great damage to crops.



Snow

Have you ever wondered about the difference between snow and sleet? They both reach the earth as frozen water and yet they are so different. Sleet starts falling as drops of water and then it freezes. Snow freezes as it forms and before it falls. When water vapour condenses in the air at a temperature below freezing point, we have snow. How are snow and frost alike?

Snow-flakes form in many different shapes but they all have six points. They form wonderful patterns as you can see in the picture on page 58.

Science and the weather

The science of weather is a very exciting science. Men have spent years trying to find out about the weather from the ground. In recent times they have been able to go up into the sky to study weather. Sometimes man goes up himself. Sometimes he sends up instruments in balloons. Sometimes he uses wonderful instruments such as radar to study the sky from the ground. Very recently he has sent satellites into space around the earth. These satellites are fitted with many instruments that tell him about the upper sky.

As man learns more and more about what makes the weather, he finds he can forecast the weather better. Do you know what weather forecasting means ? It means telling what the weather will be. Weather stations have been set up where men study the weather and try to forecast what it will be. Perhaps you have read their forecasts in the newspapers. Their forecasts are very necessary for pilots.

Some day man may learn enough about the weather to begin controlling it. During your lifetime man will make some wonderful discoveries about weather.

What did you learn ?

Water is constantly moving into the air to form water vapour. This movement is called evaporation.

Water vapour comes out of the air to form drops of water or ice. This is called condensation.

Dew is formed when water vapour condenses on objects on the ground.

If the objects are freezing cold, frost is formed instead of dew.

Water vapour condenses on tiny particles in the air to form clouds in the sky or fog near the ground.

If it is freezing cold when water vapour condenses in a cloud, snow is formed.

Sleet forms when raindrops fall through cold air and are frozen.

Hail forms when sleet is blown back up into clouds, falls and is blown back again. Each trip up and down adds more ice to the hailstone.

Things to do

1. Read the weather forecasts in a newspaper for two weeks. How often are they right ?

2. Try to find out how many centimetres of rain falls in your neighbourhood each year. Find out how much falls in other parts of India.

3. Make a rain gauge so that you can find how much rain falls in a storm. Find a large jar or tin can and place it in the open. After a rainstorm you can measure the depth of the rain that has fallen by using a scale.

4. Keep a weather chart for a week or more. For each day you can record the temperature, wind direction, whether the wind was gentle or strong, the appearance of any clouds, the amount of rainfall.

5. Try to find someone in your locality who is good at forecasting weather. Ask him to tell you what changes he notices in nature that help him to tell what may happen.

Questions to answer

1. Describe how frost forms.

2. Describe how hailstones are formed.

3. State which of the list below are examples of condensation and which are examples of evaporation.

   a. plants wilting.

   b. fog forming.

   c. dew forming.

d. dew disappearing.

e. sweat drying.

f. window panes becoming cloudy.

4. Have you ever seen a jet flying through the sky ? As the hot gases pour out of the jet's rear they make a long thin cloud in the sky. Explain how this cloud is formed.

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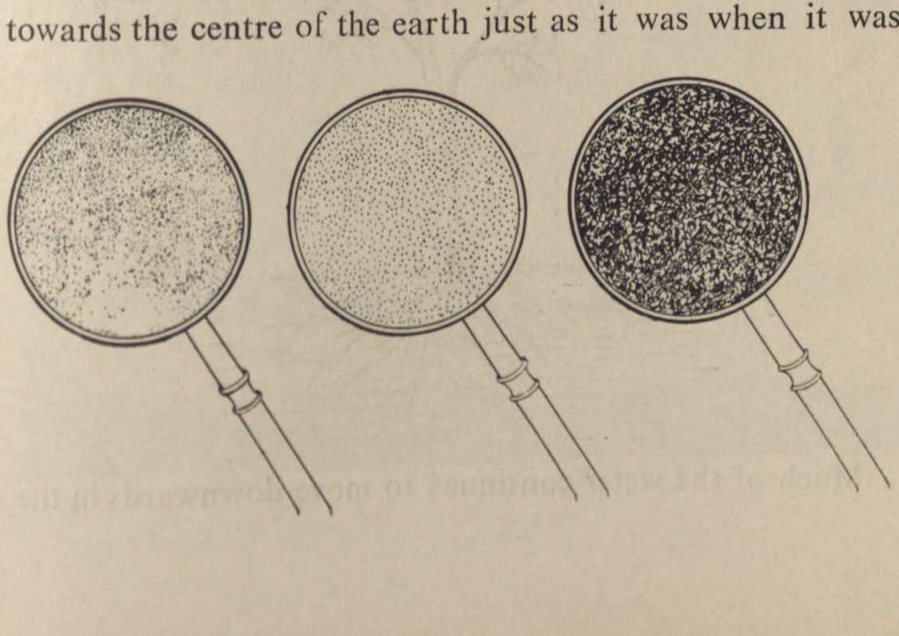
10. Water under the Ground

Water vapour comes out of the air in many ways. It condenses to form dew, frost, rain and snow. Some of this water soon evaporates as it is heated by the sun. But much of the water makes a long trip before it returns to the air. Where does this water go ?

When rain falls or snow melts, some of the water flows along the surface and joins streams or rivers. Some of the water soaks into the ground. Let us follow the water that soaks into the ground.

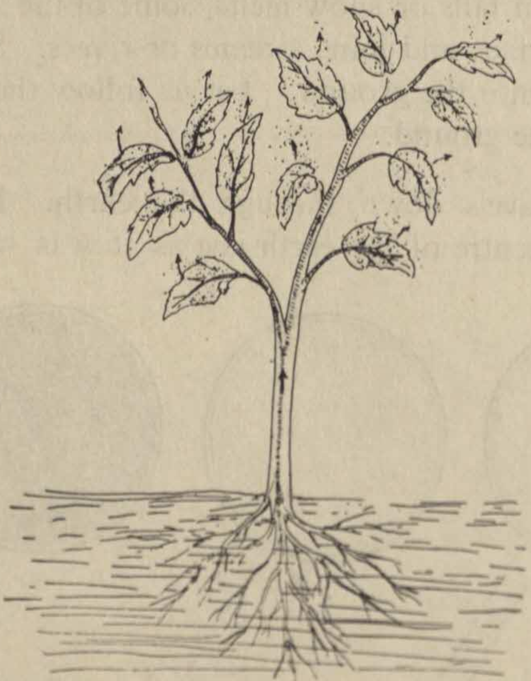
Water travels down through the earth. It is pulled towards the centre of the earth just as it was when it was



falling through the air. It travels down very quickly through sandy soils and much more slowly through clayey soils. It passes more quickly through sand because the spaces between the sand particles are larger than the spaces between the clay particles. We say that sand is very *porous* because it has many holes.

Do you remember that loamy soil is the best soil for growing most plants ? It is less porous than sand and holds the water for plants.

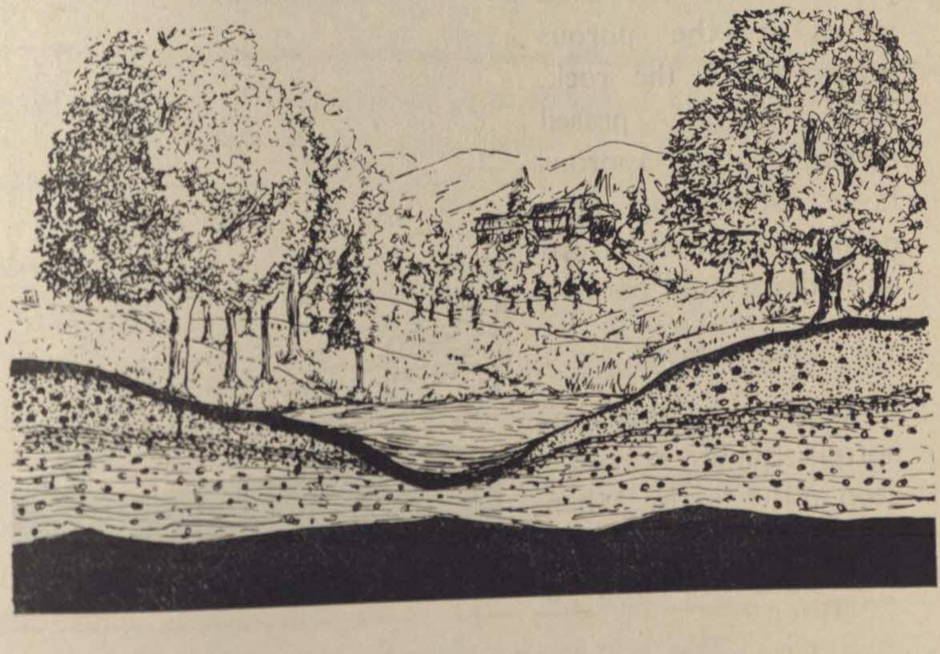
As the water travels through the soil it is taken in by the roots of many plants. It travels through the plants and may be used to make food. A great deal of the water evaporates again into the air.



Much of the water continues to move downwards in the soil. It keeps moving until it hits a layer of rock that has no holes in it. Rock without holes large enough for water to pass through is called *non-porous.* Not all rocks are non-porous. Some rocks are porous and the water seeps through these kinds of rock. It stops only when it reaches non-porous rock.

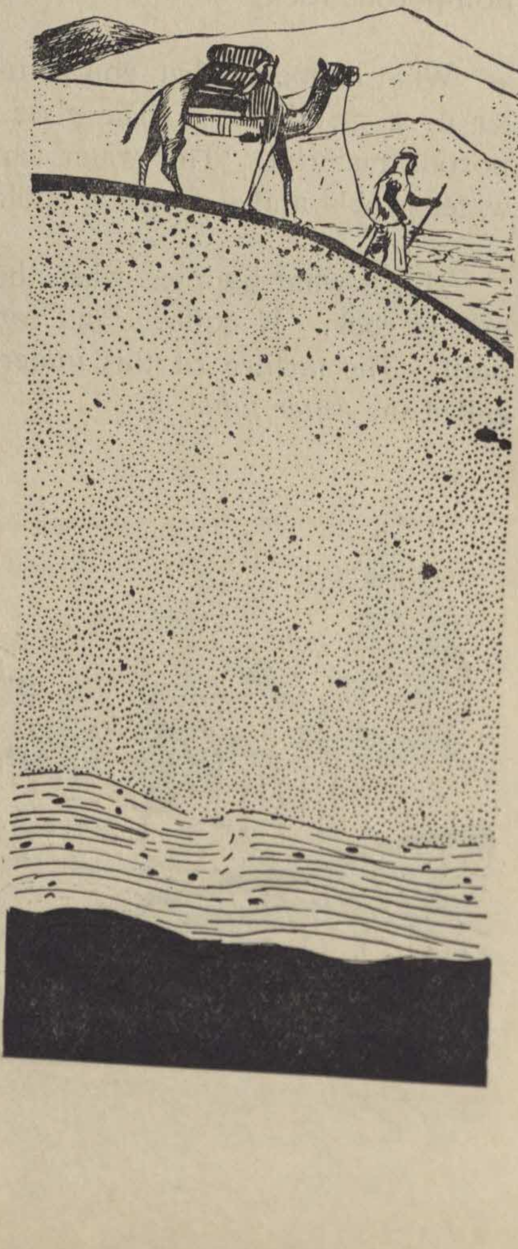
What happens when you pour water into a glass tumbler or a metal pot ? The glass or pot is made of non-porous material. The water cannot seep through. The water is held and it forms a pool.

This is what happens when the water reaches the non-porous rock. It collects and forms a large underground pool. The surface of this underground pool of water is called the *water table.*



Do this

Fill a large pot, tin can or bucket with sand. Pour in enough water to soak the sand. Place the pot in the sun for an hour. Now dig carefully into the sand. The top of the sand would be quite dry but after some digging you would reach water. You would reach the *water table* of your small piece of land. If you keep digging you will make a hole filled with water.



The bottom of the pot served as the non-porous rock. It stopped the water. The sand serves as the porous layers above the rock. The water passed through the porous layers, struck the non-porous layer and formed an underground pool.

Water tables

Sometimes the non-porous layer is quite deep in the earth. When this is so and there is little rain we find a desert. The water table is far underground.

Sometimes the water table is just beneath the surface of the earth. When this happens, the ground is very soggy and we find a swamp.

Sometimes the land dips below the water table. What do we find then ? We find a pond or lake.

If the water table is close to the surface of the soil but not high enough to make a swamp, there is probably plenty of water for growing good crops. If the water table is quite far down, farmers will probably need to provide special water for growing crops. They will have to irrigate their fields.

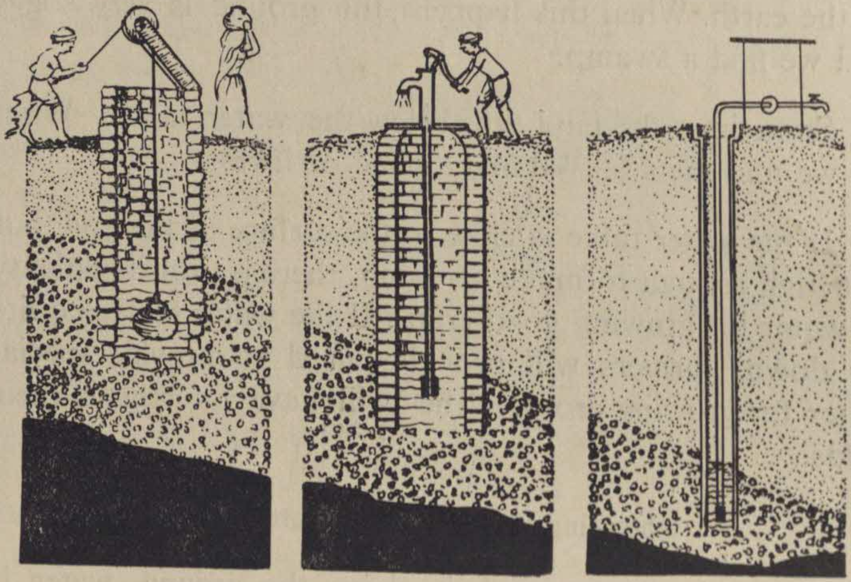
Obtaining water from the water table

When the water table is above the ground, water is easily available. We only have to scoop it up from a lake or a pond. But if the water table is underground, we must dig down to reach water. We must dig a well.

Do this

Use the same pot of sand you used in making a water table. If it has become quite dry, add water until you believe the water table is close to the surface.

Obtain an empty tin can and remove both ends. You have made a tube of tin. Push the can into the sand until only an inch sticks out above the sand. Now dig out the sand inside the can. You will find water coming in to replace the sand. You have made a well. The top surface of the water in the well will be the same height as the water table.



Look at the pictures of the wells. What kinds of wells do you have in your neighbourhood ? There are many kinds of wells but they must all reach down to the water table.

What did you learn ?

Material with holes in it is called porous.

Water passes through porous material.

Material without holes large enough for water to pass through is called non-porous.

The top of underground water is called the water table.

Deserts are formed when there is little rain and the water table is deep in the ground.

Swamps are formed when the water table is close to the surface of the ground.

Lakes and ponds are formed when the land dips below the water table.

Wells are special holes dug to reach the water table.

Things to do

1. Try to discover the depth of the water table in your neighbourhood. Does it change from season to season ?
2. Is there a swampy place in your neighbourhood ? Visit it and dig a hole to see how deep you must go to reach the water table.
3. Are there deep wells in your neighbourhood ? Try to discover how water is brought to the surface in these deep wells.
4. Dig for water near the shore of a lake or pond. Is the water you strike at the same level as the surface of the lake or pond ?

Questions to answer

1. Are the following statements correct ? If not, correct them.
    a. The top of the non-porous layer of rock is called the water table.

b. Sand is more porous than clay.

c. In swamps the water table is far from the surface.

d. All wells that give water reach the water table.

e. Most plants grow best when the water table is far under the surface of the ground.

f. Loam holds water best for most plants.

2. Describe what would happen in your locality if the water table rose four metres. What would happen if it fell four metres ?

11. *Water above the Ground*

As you know, not all the water that falls from the sky seeps into the ground. Some of it runs along the surface.

Have you ever watched rain striking bare ground? What happens to the soil? Look around your school grounds or your home after a rainstorm. Has the water carried away any soil? Do you see any little stones sticking up that were covered before? Look closely. Look at the small streams made by the rain during a storm. Is the water clear or is it muddy?

Running water can carry many things. Small streams made by the rain can carry away particles of soil. Large streams and rivers can carry not only particles but stones as well. They push and roll stones along and wear them smooth.

Do this

Using a hammer or a piece of hard rock break a soft rock or brick into pieces. Look at these pieces carefully. Are they jagged or smooth ?

Place several pieces in a glass jar or a tin can that has a tight cover. Fill the jar or can half full of water and, after putting on the cover, shake it up and down hard for a hundred times or more.

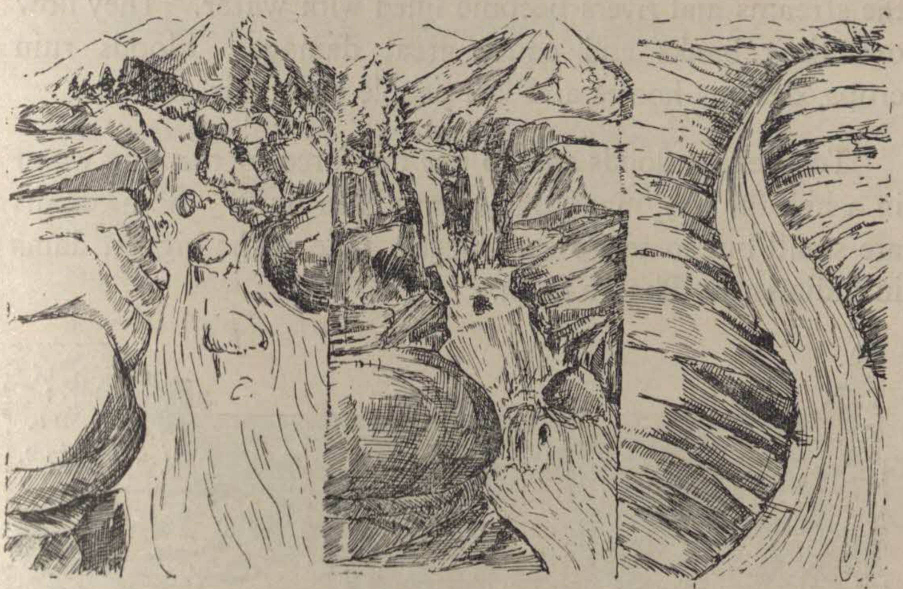
Open the jar or can and look at the water. Is it clear ? Pour the water through a handkerchief or other piece of fine cloth into a glass tumbler. What remains in the handkerchief after the water has passed through ? Compare the pieces of rock or brick that have been shaken up with the pieces that have not. Examine any small particles in the handkerchief and look at the water in the glass. What has happened ?

The next time you visit a fast-moving stream, examine some of the rocks at the bottom. Are they rough or have they been worn smooth ?

How valleys are made

Running water pushes with force. Have you ever tried to stand up in a fast-moving stream ? The stream pushes and rolls stones along and it cuts soil away from its banks. Between its banks the stream flows along in what we call its bed. Gradually it makes its bed deeper and wider.

Look at the pictures on the next page, showing how a stream makes a valley. It does not make a valley in a



month or a year. Through hundreds and hundreds of years it slowly wears away the earth.

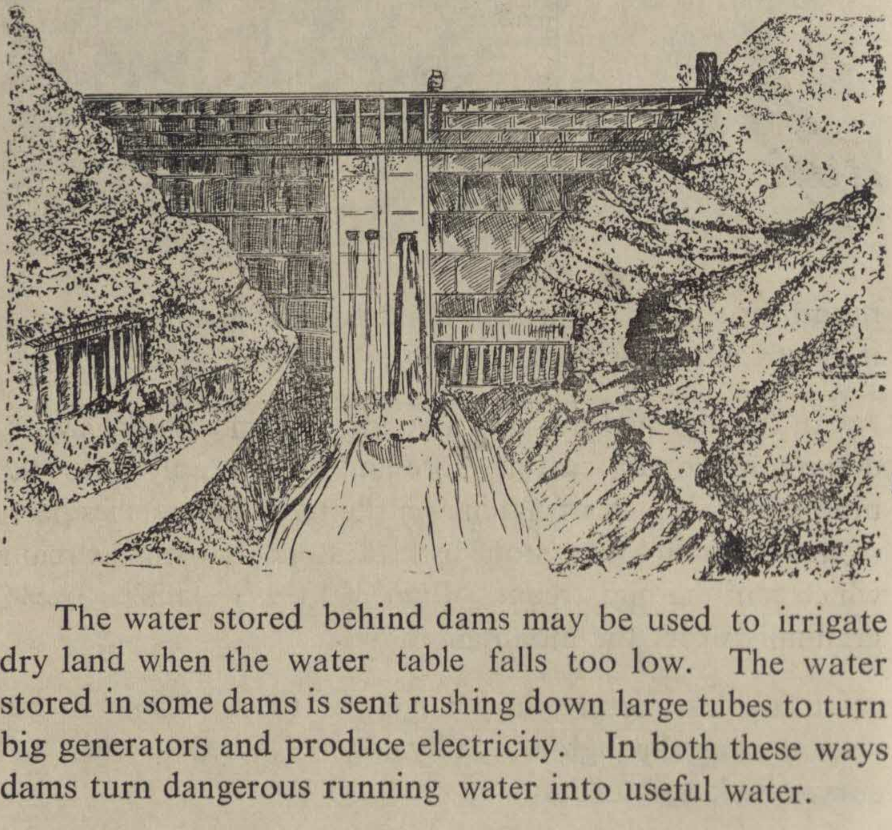
In the first picture, it is a young stream rushing swiftly down a mountain, cutting more and more deeply into the mountain side. Rain falling on the mountain washes parts of the mountain, little stone by little stone, into small streams which join the big stream. Rain, helped by other forces, gradually wears the mountain away.

In the last picture the young stream has become an old river moving through a broad valley. Its bed is wide and curves back and forth.

Dangerous running water

Sometimes streams and rivers use their force in ways harmful to us. So much rain falls or so much snow melts that the streams and rivers become filled with water. They flow over their banks and cause great damage. Floods ruin crops, destroy homes and kill people and their animals.

To prevent floods and to use the force of running water in a helpful way, many dams have been built. Some dams are small but some are very large. One of the biggest dams in India is the Bhakra Dam.



The water stored behind dams may be used to irrigate dry land when the water table falls too low. The water stored in some dams is sent rushing down large tubes to turn big generators and produce electricity. In both these ways dams turn dangerous running water into useful water.

What did you learn?

Rain and small streams can carry away particles of soil.

Streams and rivers carry along soil and stones.

Streams and rivers run in beds.

As streams grow older they make their beds larger.

Swift mountain streams grow to become rivers in the valleys.

Dams control water to use for irrigating land and generating electricity.

Things to do at home

1. Watch any stream or river in your neighbourhood from month to month. What changes do you notice ? Are the banks wearing away ? Are dirt or stones being moved along ?

2. Watch a piece of sloping land for a month or six weeks. Visit this slope every two or three days to notice the effect of running water on the soil.

3. Make a model of a mountain range and nearby country. Do this in the open. Using stones and soil, build up mountains and hollow out valleys, Make some smooth, flat lands. Watch the effect of rain and running water on your model. If you are in a dry season, you can make rain by punching some holes in the bottom of a tin can and filling the can with water.

4. If there is a very small stream in the neighbourhood, try making a dam across it. Perhaps you can build an irrigation system. If water is not scarce in your

locality, perhaps you can use some running water to make a small stream for you to dam.

5. Find out if there is a dam, or a plan to build a dam, near where you live. Try to discover the reasons for building the dam. Perhaps you can visit a dam and study how it was built and how it works.

Questions to answer

1. Write the history of a drop of rain from the moment it hits the ground until it is flowing into the sea. Tell what this drop and its fellow drops do as they flow to the sea.
2. Describe the changes that take place in a stream bed as the stream becomes older.

12. *Making Dirty Water Clean*

When water falls from the sky it is clean. Before it returns to the air as water vapour it may be used in many ways. It may become dirty and unfit for washing and drinking.

Some water is used by animals and passes out of their bodies. Some water is used for washing and some for carrying away the wastes from our foods and from our bodies. These wastes we call *sewage*. Water with the wastes of animals and man in it is not safe water. It is *polluted* water.

Do this

Fill a large glass jar with muddy water. You may do this simply by adding some soil to clean water. Stir the water and then watch what happens. Let the water rest while most of the soil particles settle to the bottom. When this has happened, carefully pour some of the clearer water at the top into a glass tumbler.

You have made some of the water cleaner. You have made it cleaner by *decantation.*

But the water is still not clean. How can we make it cleaner ? We can make it cleaner by *filtration.*

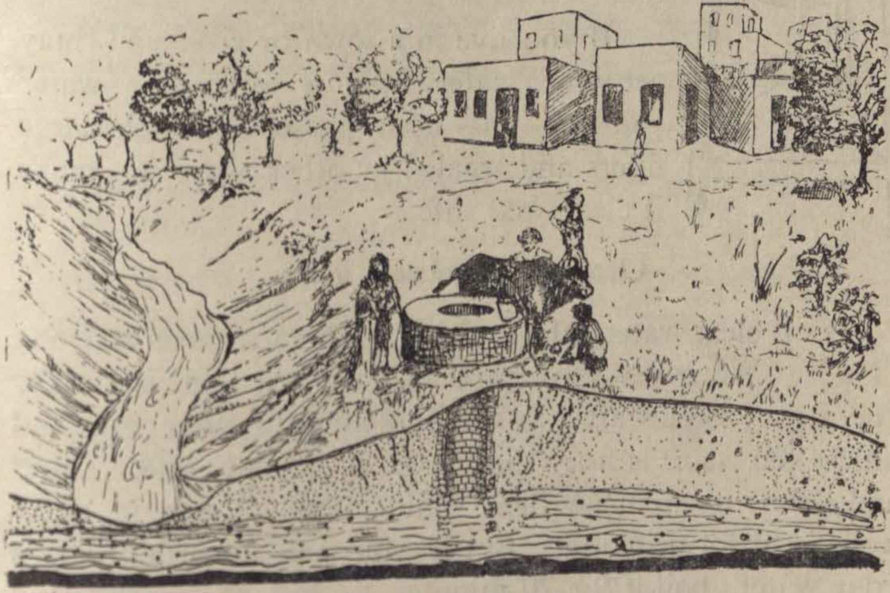
Obtain a tin can or any other container which is open at the top and which has a bottom in which you can make many little holes. The container should be more than 20 centimetres high.

Pour about 8 cm of clean gravel into the bottom of your container. Gravel is a mixture of small stones and pebbles. On the top of the gravel add 8 cm of clean sand. You have made a filter. Place this filter on top of another glass tumbler. Pour the dirty water from the other tumbler into the top of the filter. Watch the water collect in the bottom tumbler. It is clean ? It will be, if you used clean gravel and clean sand.

You may want to pour some of the dirty water remaining in the jar into the top of your filter to test your filter further.

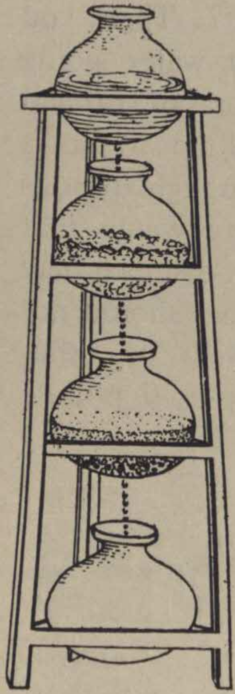
Filtered water

Have you ever drunk water from a well ? Then you have used filtered water. Remember how water going underground seeps down through porous layers of soil and rock ? These porous layers act as a filter and the water is cleaned. If dirty water passes far enough through porous layers it will become safe for use. But dirty water that passes through porous layers for only a short distance may not be made safe. Animals and human beings should not be permitted to empty their wastes near wells or other sources of drinking water. If they do, they will pollute the water.



Look at the woman dumping sewage on to the ground.

She is too close to sources of drinking water. The dirty water will not travel far enough through the porous layers to be safe. It will not be filtered well and will remain polluted.

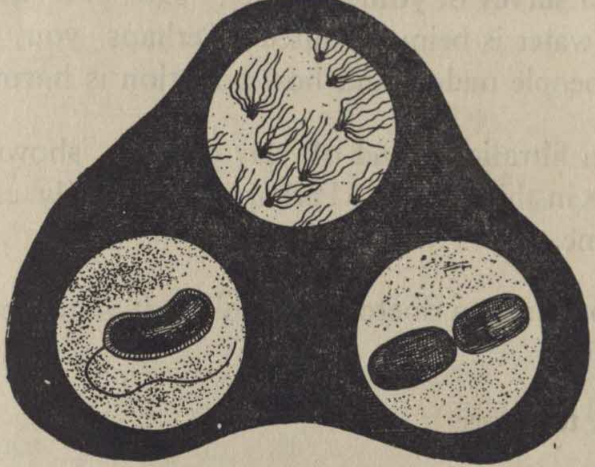


Perhaps you have an arrangement of pots like this at home for filtering water. The top three pots have fine holes in their bottoms. The dirty water is in the top pot. The second pot contains charcoal and the third pot contains sand and gravel. The water is cleaned as it passes through the middle two pots. Finally the clean water drips through a piece of muslin cloth and is collected in the bottom pot.

If you live in a town or city you may get your water from a tap. The water you use has been passed through large filters and treated in other ways to make it clean and safe.

Clear water and safe water

Is all clear water safe to drink ? The answer is a strong "No !" Water may look good and taste good and still make you sick. Germs are too small to see with your eye and unless the water is free from germs it is not safe. Cities and towns try to make their water safe. Water in many wells is fit for drinking. But if you are uncertain about your water, boil it for 20 minutes to kill the germs and make it safe.



What did you learn ?

Wastes from our food and bodies are called sewage.

Water made dirty by wastes is called polluted.

Large particles of dirt can be removed from water by decantation.

Large and small particles of dirt can be removed by filtration.

Waste water should not be emptied near sources of drinking water.

Clear water is not always safe water.

Boiling water for 20 minutes kills the germs in it.

Things to do at home

1. Where does your drinking water come from ? How is it made safe for drinking ? If it comes from a tap, try to find out where and how it is treated,

2. Make a survey of your locality. Do you find places where water is being polluted ? Perhaps you can help other people understand how pollution is harmful.

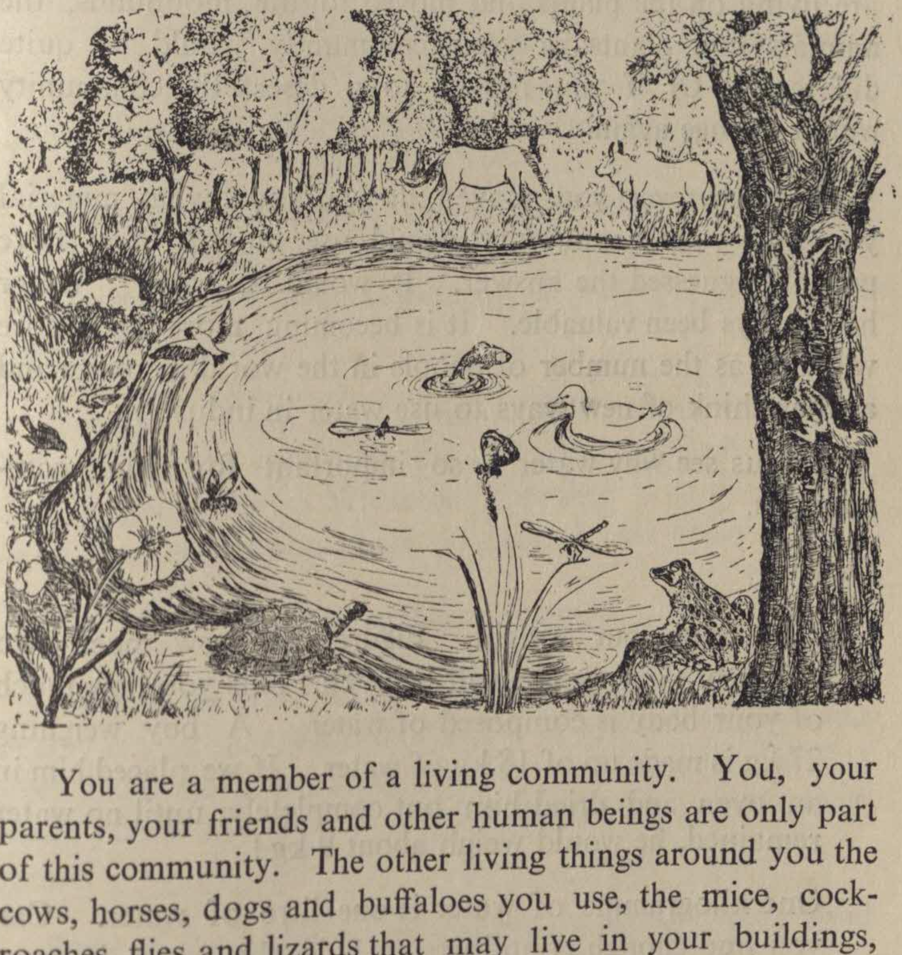
3. Build a filtration stand of clay pots as shown in the picture in this lesson. Perhaps your family can use it at home.

4. Find out from a doctor how polluted water can make you sick.

Questions to answer

1. Are the following statements correct ? If not, correct them.
   (a) Clear water is never polluted water.
   (b) Decantation does not remove as fine particles from water as filtration does.
   (c) Water is filtered as it seeps through porous rock and soil.
   (d) Water does not have to travel far through the porous layers to be made safe.
   (e) Filtered water is always fit for drinking.

13. *Water and Living Things*



You are a member of a living community. You, your parents, your friends and other human beings are only part of this community. The other living things around you the cows, horses, dogs and buffaloes you use, the mice, cockroaches, flies and lizards that may live in your buildings, the birds and other wild animals that live around you, the plants of your neighbourhood, all of these from part of your living community too. When you think of your community in this way it becomes a very active place. A great deal is going on all the time.

If you were to move to another village or town you would become part of another living community. If you are living on the plains and moved to the mountains, the animals and plants in your community would be quite different. Or if you moved to a desert the community would change again.

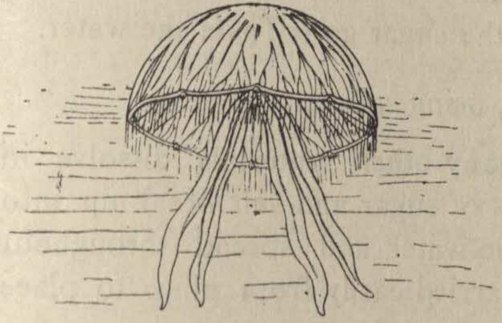
But wherever you moved, do you know what material you and your community would use most? You have probably guessed the answer. It would be water. Water has always been valuable. It is becoming more and more valuable as the number of people in the world increases and as they think of new ways to use water in industry.

Let us see why water is so important for living communities.

Do this

Find out your weight. Figure out how much two thirds of your weight will be. This tells you how much of your body is composed of water. A boy weighing 27 kg is made up of 18 kg of water. If we placed him in an oven and dried him out completely, until no water remained, he would weigh about 9 kg!

One kilogramme of water is one litre of water. Can you find enough containers to hold the water in your body? See how much it is.



All animals are composed largely of water. Many have even more water in them then you have. If you have ever visited the sea, perhaps you have seen a jellyfish. If you were to weigh one of these animals and then dry it out completely, you would find that more than nine tenths of its body is composed of water.

Plants also are largely made up of water. More than nine tenths of young leaves and fruits are water. About half of the woody stems is water, and even dry seeds are one tenth water.

Obtain a tomato or some other fruit and weigh it carefully. Then cut it up into thin flat slices and put them in the sunlight to dry. When the pieces are completely dry, weigh them to see how much weight has been lost.

How living things use water

Some of the water in living things is part of them, just as clay is part of a brick building. Do you remember that green plants make their food from water and carbon dioxide? Green plants and animals also use water to build their own bodies.

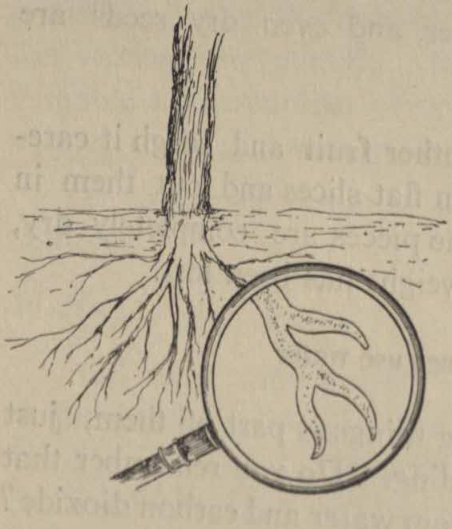
Some of the water in living things is used to carry food and other materials from place to place.

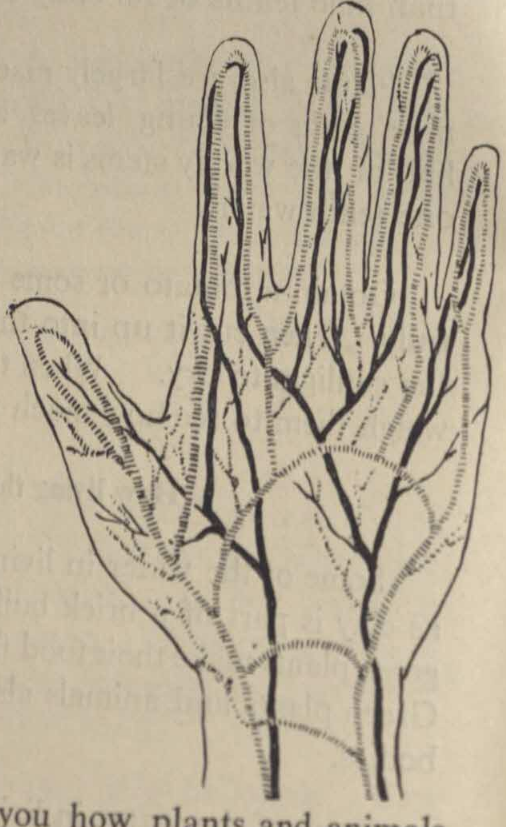
Do this

Add sugar to a glass of water and stir the water thoroughly. Where does the sugar go ? Taste the water.

Repeat this experiment using salt.

Sugar and salt and many other materials dissolve in water. That is, the grains of sugar and salt break up into even smaller particles in the water and spread throughout the water. They can be carried easily from place to place when they are dissolved.





These two pictures show you how plants and animals use water to transport materials they need. In the first picture you are looking at a very small part of the root of a plant. It has been drawn large enough for you to see. Water and minerals enter plants through the roots, but the minerals enter only when they are dissolved in water. In water they come into the plant and are carried to all the other parts of the plant. In the same way food that is made in the leaves is dissolved in water and carried to the fruits, flowers, roots and stems.

In the other picture on page 86 you see some of the blood vessels of your hand. The liquid part of blood is called *plasma*. It is mostly water. Many substances are dissolved in the water of your plasma and are carried around your body. When you eat food, your body acts on it until it is dissolved in water. Only then can it enter blood and help you live.

What did you learn?

Water is the material most used by a living community. Most living things are composed largely of water.

When materials break up into tiny particles and spread throughout water, we say they dissolve in water.

Many materials dissolve in water.

Water is used to build living bodies.

Water is used to transport dissolved materials in living things.

Plasma is the fluid part of blood.

Things to do

1. Some of the water you need each day you get in the food you eat. Some of the water you drink as water

or in tea, fruit juices and the like. Keep a record of how much fluid you drink for several days.

2. Try dissolving different substances in water. You might try chalk dust, pepper, a piece of candy, a piece of soap, a little honey, fine sand. Keep a record of which dissolve and which do not.

3. Some animals do not need to drink any water as they get all the water they need in the food they eat. See if you can discover which animals live in this way.

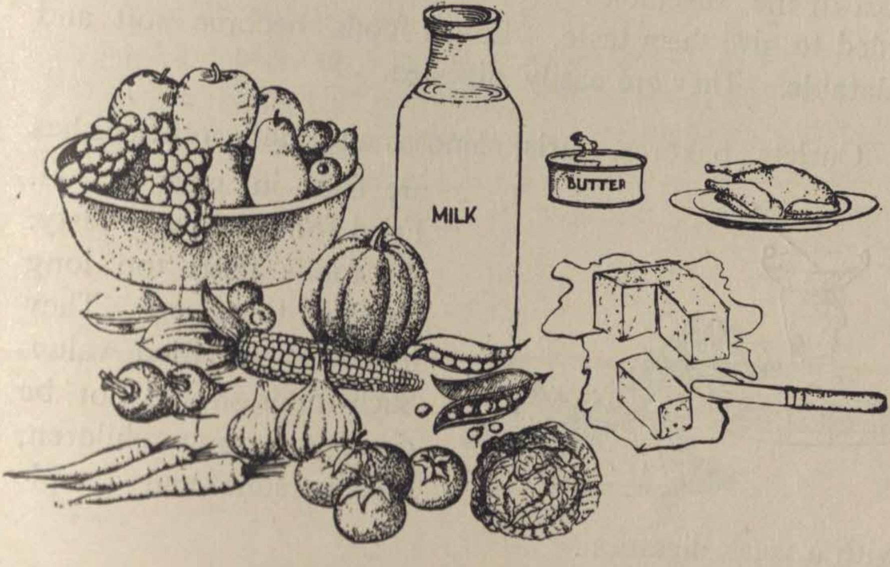
4. Obtain a glass of sugarcane juice and let all the fluid evaporate. Taste what remains. All plants carry sugar in the water of their bodies but not so much as the sugarcane plant does.

Questions to answer

1. Fill in the following blanks with a correct word :
   (a) When sugar disappears in water, we say it has . . . .
   (b) The fluid portion of the blood is called . . . .
   (c) A man weighing 69 kilogrammes will contain about . . . . . . kilogrammes of water.
   (d) A bag of grain weighing 56 kilogrammes will contain about . . . . . . kilogrammes of water.
   (e) You and all the living things around you compose a living . . . .

2. Describe three different ways in which a green plant uses water.

14. *How Your Food is Prepared*



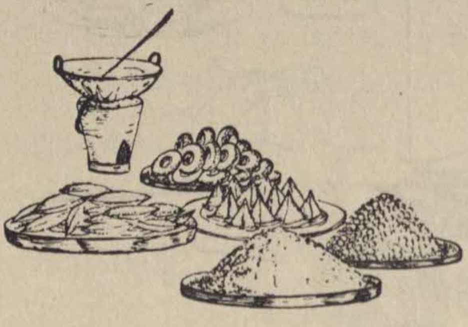
All of us eat various types of food. We eat grains such as wheat, maize and rice. We eat pulses, vegetables and fruits also. Some of us eat meat and eggs. We take milk in various forms.

Most of us do not eat the same kind of food every day. We change our food with the seasons. But many of us drink milk every day. Many of us eat chapattis daily. Vegetables and fruits that we eat usually differ from season to season.

Not all the foods that we eat are cooked. Many fruits and vegetables are eaten raw. Can you list some of them ?

We cook our food in various ways. *Boiling* is one common method of cooking. Pulses, rice, patatoes and most of the vegetables are boiled. Salt and spices are added to give them taste. Boiled foods become soft and palatable. They are easily digested.

Cutlets, pakoras, puris, samosas and many other dishes are fried in ghee or oil. Fried foods are very tasty. But foods fried too long are hard to digest. They lose a lot of food value. Such foods should not be given to young children, sick persons and people with a weak digestion.



Some vegetables are fried with ghee and spices. List some fried vegetables which you eat.

Have you eaten a papad ? Sometimes it is fried in ghee. Often it is roasted on red-hot coal. Potatoes, sweet potatoes and corn cobs are often roasted in hot ash. Name some other articles that are roasted for eating.

Bread is prepared by baking flour after mixing it with baking powder or yeast. There may be a bakery in your neighbourhood. Visit the bakery and observe how the oven is heated and what foods are baked inside it. How is bread prepared ?

Steaming is another very healthy way of cooking food. Foods are cooked in steam by placing them over water in a closed vessel. Food cooked in this way does not lose its food value and is also easy to digest.

List in a table all foods eaten by you. Write against each kind of food, whether it is cooked by boiling, frying, roasting, baking or steaming. Some foods are prepared in more than one way. Prepare your table as shown below :

Name of the food	Boiled	Fried	Roasted	Baked	Steamed

Boil your milk before use

Grains and vegetables are cooked. Milk is boiled. You know that germs are found everywhere. Milk gets these germs more easily than other kinds of food. Germs are usually on the teats of cows or buffaloes if they are not looked after well. The hands of a milkman may also have germs if they are not washed well. They may be in the bucket which contains milk. These germs may enter your body when you drink the milk. It is therefore very important that milk should be boiled before use. Boiling kills germs.

What did you learn ?

We eat many types of food.

Some foods are cooked and some are not cooked.

There are various methods of cooking.

Food may be boiled, fried, roasted, baked or steamed.

Milk should always be boiled before use.

Things to do

1. Visit a gaushala and observe how cows are milked. Does the milkman wash his hands well before milking a cow ? Does he wash the teats of the cow ? Does he wash the bucket in which he milks the cow ?

2. Observe your mother at work in the kitchen. What foods does she prepare by boiling, by steaming and by frying ?

Questions to answer

1. In the following list of foods, which are cooked and which are eaten raw ?

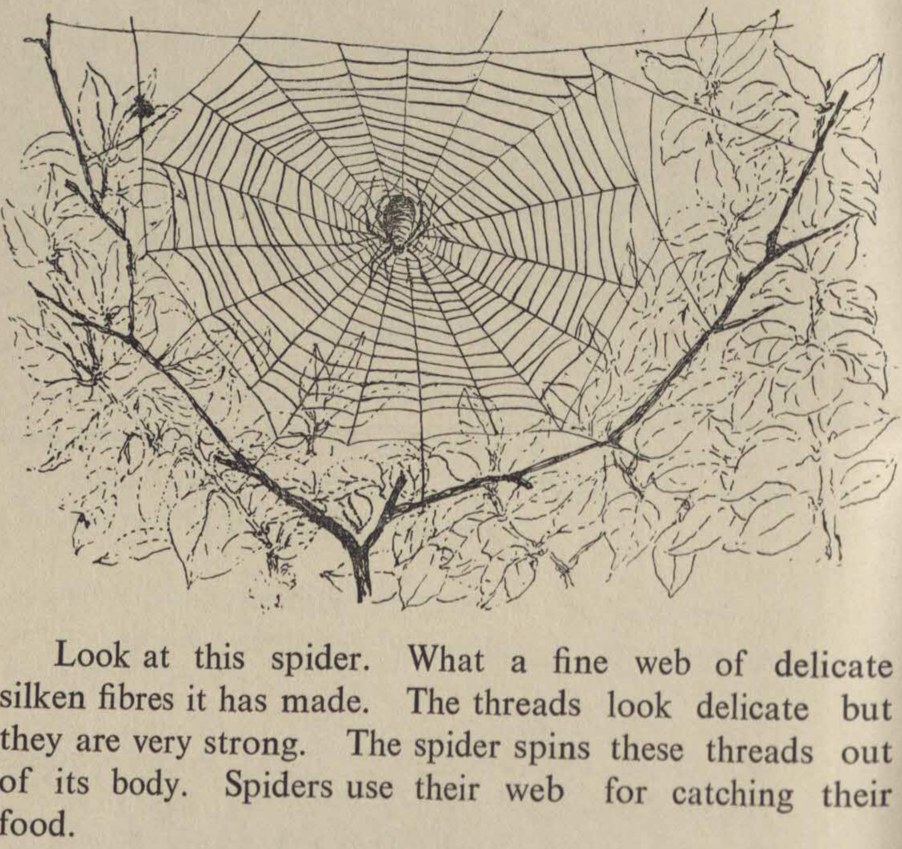
   Cabbage, rice, orange, wheat, sugarcane, pineapple, karela, lemon.

2. What method of cooking is used in preparing the following dishes:

   Arvi, rice, biscuits, halwa, khir, papad, sweet potato, spinach, cabbage, meat, eggs.

3. Name four vegetables that can be eaten raw as well as cooked.

15. *How Your Cloth is Made*



Look at this spider. What a fine web of delicate silken fibres it has made. The threads look delicate but they are very strong. The spider spins these threads out of its body. Spiders use their web for catching their food.

Perhaps man got his inspiration for making cloth from seeing the spider spin its web.

We wear so many different types of clothes round the year. Where do they come from ?

All cloth is made from fibres. Hair is a fibre. Many animals grow hair. You also grow hair. But we do not use our own hair for making cloth. Our hair does not grow long quickly enough to be made into cloth.

There are other animals which grow much more hair and much more quickly than we do. People have found

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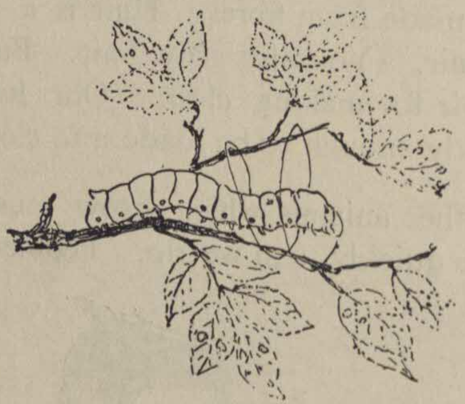
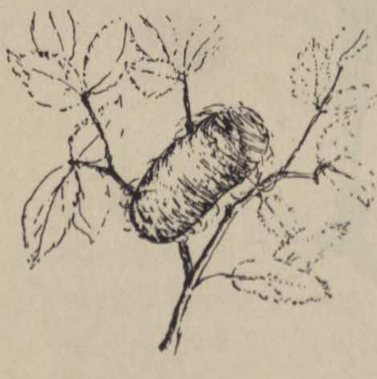
how to use the hair of these animals to make cloth. On page 95 some animals are shown whose hair is used to make cloth.

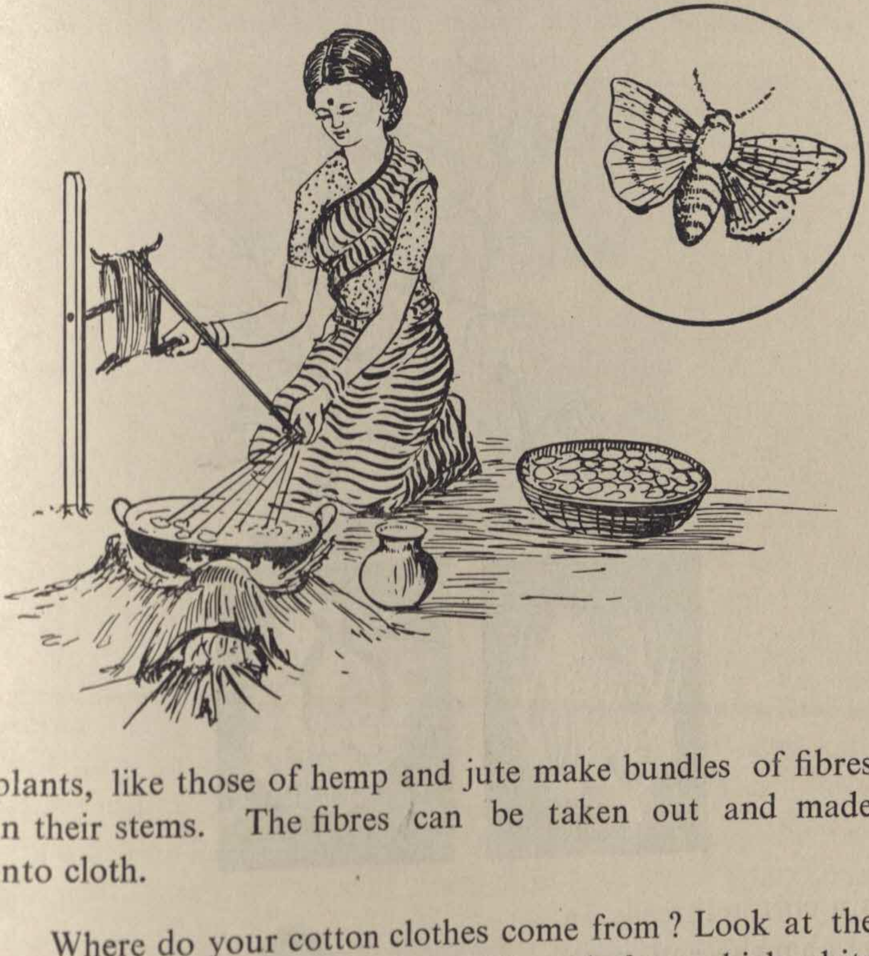


You get thread from insects too. Look at this caterpillar. It is making for itself a shell of silk fibre. This fibre it has made out of itself. When finished, it will look like this. Inside the cocoon the caterpillar will change into a moth. When it comes out, it will look like the moth on page 97.



The silkworm moth makes cocoons of silk fibre. This fibre can be made into very soft, smooth and shining cloth. People unwind the silk fibre from the cocoon and make the threads into silk cloth.

Plants also make fibres. Plants do not grow hair like animals but they have threads of a different kind. Some



plants, like those of hemp and jute make bundles of fibres in their stems. The fibres can be taken out and made into cloth.

Where do your cotton clothes come from ? Look at the cotton plant on page 98. It has big pods from which white cotton is coming out. When the cotton fruit gets ripe, it opens and the seeds come out.

Each seed has many little white fibres of cotton on it. These fibres are soft.

Long ago all the cloth used to be spun and woven only by hand. Even now in many places people

spin cotton threads on the charkha and wear cotton and silk cloth made on handlooms. Today, however, machines are used to make cloth out of cotton, silk, wool and other fibres. Machines help us to make cloth

in large quantities, so that they can clothe many people.

Today scientists have found ways of making new fibres. They make threads out of all kinds of things which will surprise you—bits of wool, straw, coal and even milk. They imitate the spider and the silkworm cocoon in drawing out long fine threads which are at the same time strong. Some of these new types of cloth are rayon, nylon and orlon.

So cloth can be made from very many kinds of things. Some fibres come from plants, some from animals and some from neither. People are still trying to find out ways of making more cloth with less expense and less difficulty.

What did you learn ?

Cloth is made from many kinds of fibres.

The hair of many animals is used to make cloth.

Insects also give us thread. The silkworm moth gives us silk thread.

The fibres of many plants are used for cloth.

Science is finding ways of making cloth from other materials also.

Machines are used to spin and weave cloth in large quantities.

Things to do

1. Make a chart of cloths. Paste little pieces of cloth of different kinds. Opposite each, put pictures of the animal or plant or material from which it comes.
2. Make a chart showing the story of silk from "eggs to cloth."

Questions to answer

1. What animals give us clothing ?
2. How is cotton cloth obtained ?
3. Is it possible to get cloth without plants and animals ? If it is, what are the cloths made in this way ?

16. *Your Nerves*

When some one snaps his fingers close to your eyes, you immediately close your eyelids. When you touch something hot, you at once pull back your hand. When there is a big thunderclap in the sky, you quickly plug your ears with your fingers.

How do you do all these things so quickly ? Do you tell yourself, every time you touch a hot thing, "Now I have touched something hot. I must take away my hand", and only then take away your hand ? Something has always made you pull away your hand even before you realized what had happened.

What helps you to feel pain, to know whether something is hot or cold, soft or rough, sharp or blunt, sour or sweet, hard or soft and so on ? It is your brain and the nerves. The brain and the nerves together form the nervous system. Your nerves are spreading to all parts of your body—up to the tips of your fingers and toes. It is your nerves that help you feel and do many things. You can see, you can hear, you can taste, you can smell and you can feel.

You do all this hundreds of times a day. Your nerves are doing it for you without your having to tell them.

You use your nerves when you listen.

You use nerves when you see.

You use nerves when you smell.

You use nerves when you taste.

You use nerves when you feel anything.

Without nerves, you would not know the difference between hot and cold, red and blue, a mango and a barfi or thunder and music.

Nerves are like telephone wires carrying messages to your brain about what is happening.

When you touch a pen, the nerves in your fingers send a message to your brain that you have touched a pen. The nerves from your nose carry messages that something nice is being cooked in the kitchen. The nerves in your ears inform your brain that two dogs are barking at each other in the street. They tell you that a car is blowing its horn behind you and that you must move to one side.

Messages travel very fast in your nerves. They carry messages to your brain. The brain at once sends instructions to your muscles to act. Your brain and nerves work together to make life pleasant and safe for you.

What did you learn ?

The brain and nerves together form the nervous system. The nerves carry messages to the brain from all parts of the body.

Nerves help us to see, hear, taste, smell and feel.

The nervous system protects us from danger many times a day.

It helps us to adjust to our environment.

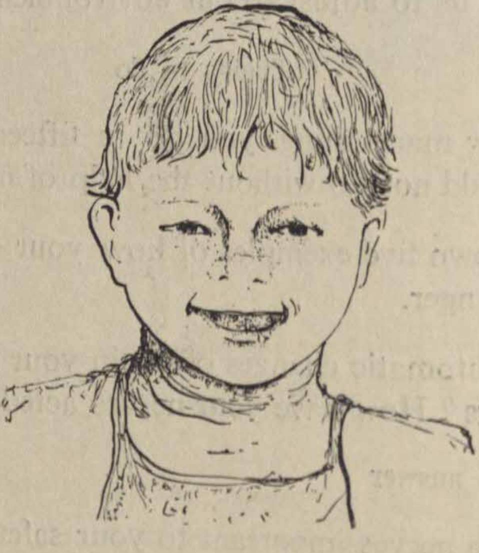
Things to do

1. List how many things you do in fifteen minutes which you could not do without the help of nerves.
2. Note down five exemples of how your nerves save you from danger.
3. What automatic changes occur in your eyes, your hand, your legs ? How have your nerves acted in each case ?

Questions to answer

1. How are nerves important to your safety ?
2. What messages do nerves carry to your brain ?

17. Your Teeth



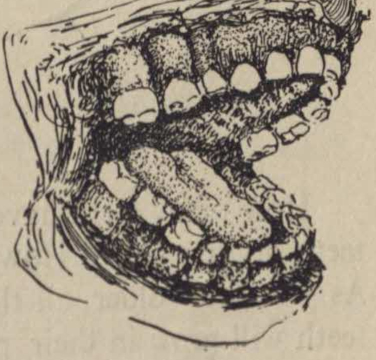
Look at the mouth of this baby. You can see only the red gums. There are no teeth. This is how your mouth looked when you were born. Then, when you were about six month old, you grew your first tooth. Then more teeth appeared, one after the other, pushing through your gums. By the time you were between two and three years old, you had all of your first set of teeth—ten in the upper and ten in the lower jaw.

But all these teeth were not of the same shape. The

first teeth to come through were the cutting teeth—four in the upper front and four in the lower front jaw. They helped you to cut off pieces of food.

Next came the first grinding teeth—one on each side in each jaw, skipping one space next to the cutting teeth.

The third to appear were the four tearing teeth, one on either side in each jaw.



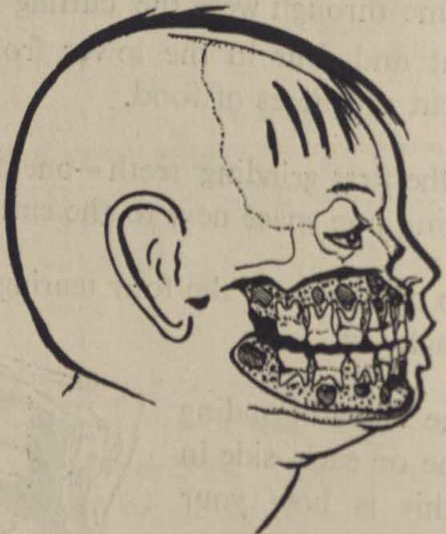
Last came the second grinding teeth—again one on each side in each jaw, and this is how your teeth looked then.

With these teeth you were able to eat most of the foods which you eat now.

Which teeth do you think help you bite into a guava ?

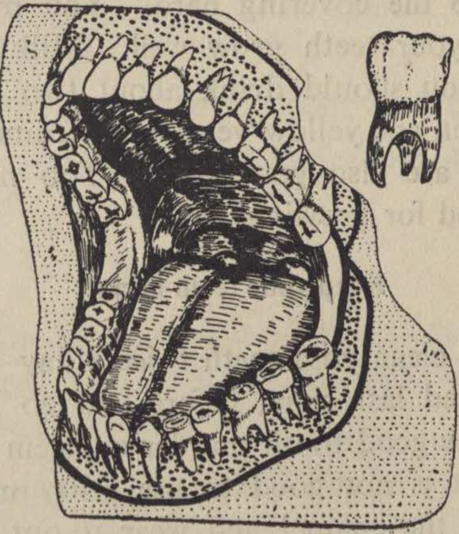
Which teeth do you think help you to mash the pieces of guava into little bits ? Which help you in tearing your chapatti ?

The first set of teeth are called *temporary* or *milk teeth*. They do not last for ever. After your first set of teeth came out, you had a resting period. No more teeth appeared. When you were six or seven years old—when you were in the first or second class, your teeth began to drop out. New teeth were, however, growing underneath the old ones. As they grew, they pushed out the old ones. The old teeth first became loose and then fell out.



How many teeth have you lost so far ? How many new teeth do you have ? How many milk teeth do you still have. As you grow older, all the milk teeth will fall off and new teeth will grow in their place.

This is how your second set of teeth will look when they are fully formed. How many are there in each jaw ? How many teeth are there altogether ?



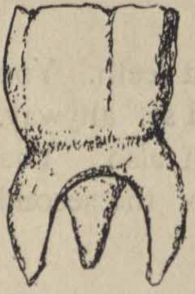
This second set of teeth are your permanent teeth. You should not think that you are getting a second set anyway. It is important to take care of your first teeth also. You have to keep the place healthy and strong for the second teeth.

It is important to take care of your second teeth too. They are the last set that you will have. If you lose them, you will not get another again.

Your teeth help you to speak clearly. A neat row of bright teeth makes your face attractive. Without teeth you cannot chew your food well.

How can you keep teeth healthy? The outside of your teeth is covered with enamel. The enamel covering must be hard if your teeth are to do their work well. Right foods will keep the covering hard. You must eat good foods to help your teeth grow well. Milk is one of the best foods. You should drink about two pints of milk every day. Green and yellow vegetables, fruits, whole wheat bread and eggs are also good food. Too much of sweet food is not good for growing teeth.

Keep your teeth clean



You should clean your teeth twice a day—first thing in the morning and last thing before you go to bed. You should use some good tooth powder or neem twig to clean your teeth. It is not good to use gritty material for it would scratch the enamel and wear it out. Clean your teeth after every meal. This will make your teeth look bright and clean. It will also remove the bits of food that that might have got between the teeth. If food is allowed to remain, it might harm your teeth. Sometimes a tooth develops a cavity and bits of food make the cavity grow bigger. Cavities make your teeth hurt very much. You must consult a dentist if you have trouble with your teeth.

What did you learn?

Teeth help to grind food and to speak clearly.

We have two sets of teeth—the first set are the temporary teeth. The second set are the permanent teeth.

The first set of teeth drop off when the second set grows underneath them.

The temporary teeth are 20 in number and the permanent teeth are 32.

We must eat good food to make teeth grow well.

Teeth must be cleaned regulary twice a day and after every meal.

Things to do

1. Look at the mouth of a cat, a dog, a squirrel, a rabbit and a horse. See the different kinds of teeth that they have. Are they like yours ?
2. Can you name some animals that have no teeth ?
3. Stand before the mirror and observe how you speak. Can you see how important teeth are to speak clearly ?

Questions to answer

1. How many teeth did you have in the first set ? How many will you have when you are grown up ?
2. What foods should you eat to make your teeth grow.
3. Why should you take as much care of your temporary teeth as of your permanent ones ?

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18. What are Germs ?

You have learnt that germs can make us sick. Germs belong to a group of tiny living things called *microbes*.

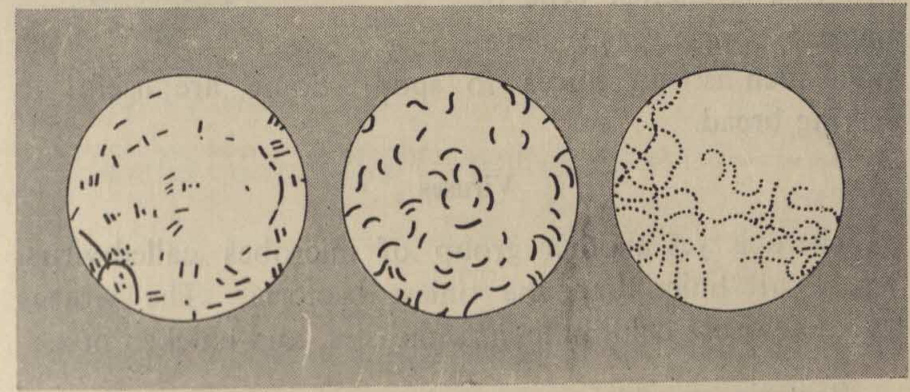
There are microbes in the air, in the ground and in the water. They are all around you. They are on your hands and on your clothes. They are on your table and on your books. But you cannot see them. They are very small. They are so small that thousands and thousands of them can be placed on the head of a pin.

You can see a microbe only under a microscope. Look at the microscope in the picture. The microscope makes a microbe look many many times bigger than it really is.

Most microbes will not harm you. Some microbes are helpful to man. Some helpful microbes are used to make medicines. Some help make changes in the soil so that plants grow well in it. Some turn milk into curd. Other microbes are harmful. They are the disease germs that make people sick.

Bacteria

Some microbes are called bacteria. If you look at bacteria under a microscope, you will find that they have different shapes. This is how they look under a microscope.



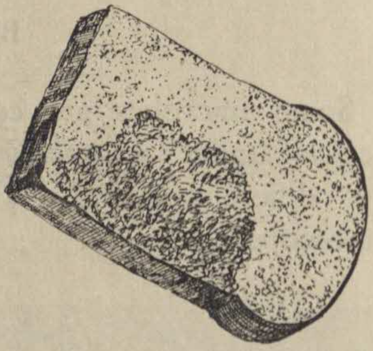
Bacteria often divide into more bacteria. Each one of them can make many more like itself.

Bacteria grow best in dark places, in wet places and in places that are neither very cold nor very warm.

Some bacteria are harmful. Some are not. Sunlight can kill most bacteria. Heat also kills most bacteria.

Mould and Yeast

Another kind of microbes are the tiny plants called moulds. You may have seen some over-ripe fruits getting a brownish growth on them. These are moulds. Perhaps you have also seen stale bread with blackish mould on it.



Some moulds are harmful to man and some are helpful to him. Harmful moulds spoil foods. Some helpful moulds are used to make medicines.

Yeast is another type of microbe. Some yeasts cause foods such as fruit juices to spoil. Some are useful in making bread.

Viruses

There is yet another group of microbes called virus. Viruses are tinier than the tiniest bacteria. The viruses we know cause cold, influenza, measles, and chicken pox.

Bacteria, moulds, yeasts and viruses can cause disease. These microbes are present everywhere. They can enter your body through the air you breathe and through the food you eat and drink. But the body has many ways of protecting you from them.

Most of the germs that enter your body with the food you eat get killed in the stomach. Germs that enter your nose through air when you breathe are kept out by the little hairs in the nose. Germs that may enter your body through a cut are killed by the cells in your blood.

Sometimes, all the germs are not killed. Those that remain in your body start to grow and soon make many more germs. When they increase in number, you get sick.

What did you learn ?

Microbes are a group of tiny living things that live around us everywhere.

There are four kinds of microbes : bacteria, mould, yeast and virus.

Some bacteria, moulds and yeasts are harmful and some are helpful.

Harmful microbes can cause disease.

Our body has ways of protecting us from disease germs when they enter it.

Things to do

1. With the help of a doctor, examine a drop of curd under a microscope.
2. Take a piece of bread. Put it on a brick. Place the brick in a small wide mouthed pot containing some water. Let the water not touch the bread. Cover it with a lid. Observe the bread after two or three days. What do you observe ?

Questions to answer

1. What are microbes ?
2. Name the different types of microbes.
3. Which type of microbe is harmful ?
4. How does your body protect you from harmful microbes when they enter it ?

19. Our Earth

Our Earth is a big round ball in space. In the day time you see the bright sun. In the night you see the stars and the moon. There are also a few bright objects which look like stars. They are planets. You will learn more about planets when you grow up. Planets give us a steady light. They do not twinkle as the stars appear to do.

There are nine planets going round the sun. Our earth is one of them. The earth is smaller than some of the planets and much smaller than the sun. It would take a million earths to make as big a ball as the sun.

How large is the earth ? If you travelled round the earth along its middle, you would travel about 25,000 miles. That is a long distance but it is small compared to others in the Universe. The Universe includes the sun, the moon, the earth, the other planets and the stars.

The earth is very very old. It had had millions of birthdays. It is older than any person or animal or tree living upon it. It is older than even our mountains.

The mountains and river valleys that you see took many hundreds of years to be formed. The rocks and sand around you took centuries to come away from the big mountains.

What do you understand when you talk of the earth ? Is it the ground you stand upon or the lands that you see on the globe ?

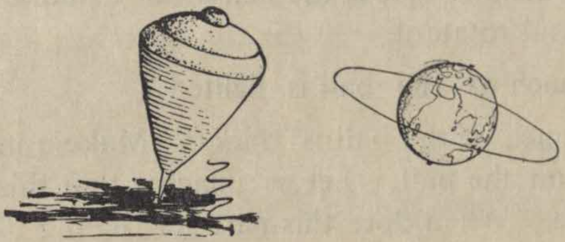
There are three parts to the earth. The land on which you and many other people live is the solid part of the earth. The waters of the lakes, oceans and rivers form the liquid part of the surface of the earth. Air surrounds the whole of the earth.

We live on the land part of the earth. We travel on the liquid part of the surface in ships and liners. We have also begun to travel in the gas part, namely the air.

We live on the surface of the land. Man has not gone down into the earth for more than about ten miles. We get coal, oil, gold, silver and iron from mines dug within this depth.

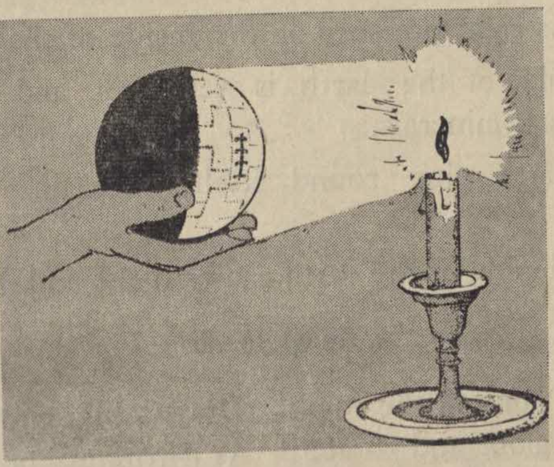
The inside of the earth is hot and heavy. You must remember that the earth is nearly 8,000 miles across. This means a tremendous pressure on the middle of the earth. The inside of the earth is so hot that it can melt even rocks, sand and minerals.

The earth is spinning round itself like a top. Have you played with a top ? It spins very fast. It spins round and round many times in a minute. This is because it is small. The earth also spins fast but it is so large that it spins around only once in twenty-four hours. Your top stops spinning after some time. You have to spin it again. But the earth is not like that. Some great force started it spinning long long ago. It still continues to spin. It will spin on for many many millions of years.



It is the spinning of the earth that causes night and day.

Do this



Take a football. This is the earth. Darken your room. Light a candle. Hold the ball at a distance from the flame and rotate it.

How much of the ball is lighted ?

How much of the ball is dark ? Make a mark with a chalk on the ball. Let us imagine that this is where you live. When does this part get light ? When does it have darkness ?

Since the earth is round, only half of it is lighted at one time. You have day for about twelve hours and night for another twelve hours.

What did you learn ?

The earth is one of the nine planets going round the sun.

The earth is very very old.

The earth is like a big round ball.

The earth is made of three parts—the solid, liquid and the gas.

There is great pressure on the inside of the earth.

The inside of the earth is very hot and melts even rocks and minerals.

The earth spins round itself once in twenty-four hours.

The spinning of the earth causes night and day.

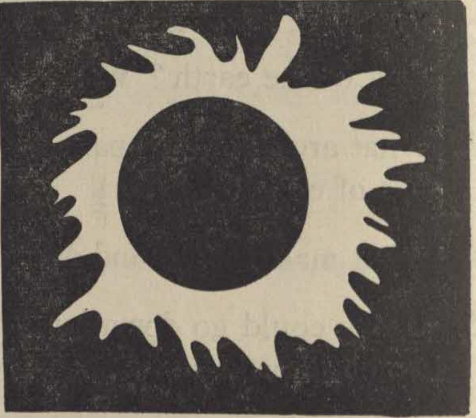
Things to do

Place a lamp in the room. Draw a big circle round it. Take a globe and rotate it. As it rotates, take it slowly round the lamp. See which parts get the light and which parts are in darkness. Which parts get direct light rays from the lamp and which parts get slanting rays from it ?

Questions to answer

1. Why does the sun look so small although it is so much larger than the earth ?
2. Will it be right to say that land is the most important part of the earth ? Why ?
3. What are the three parts of the earth ? What is the use of each ?
4. What makes night and day ?
5. If you could go down into the centre of the earth, what would it be like ?

20. *The Earth's Special Star*



Can you imagine a day when you get out of bed and find no sun in the sky. You would perhaps think the sun is behind the clouds and will come out later. Suppose it did not come out for a whole day. You would have to go to school in the dark. Lights will have to be kept on all through the day on the streets and in the school and at home. Suppose the sun did not come up at all for a whole week. Plants would grow pale and die. They cannot make food without sunlight. You cannot get vegetables and fruits without the sun. The world cannot live without the sun.

But the sun never fails to rise. The sun is the brightest light that we know. It is brighter than any starlight, moonlight or electric light.

The sun is really a star. It is one of the millions of star that you see in the sky. It is not the biggest or the brightest star, but the other stars are so far away that they seem so much smaller and dimmer. The sun is the nearest star to us, though it is 93 million miles away. If an aeroplane travelled at the rate of 700 miles an hour, it would take 15 years to reach the sun. The sun is very much bigger than the earth. It would hold a million earths.

No one has ever been to the sun but scientists have been watching and studying it for many years. They have found that the sun is not solid like the rocks of the earth. It is made of gases like our air. The sun's gases are so hot that they glow. The sun glows with its own light. Its light comes from the hot glowing gases of which it is made.

The sun is so hot that no one could get near it without being burnt up. It is so bright that it is not wise to look directly at it. Take a piece of smoked glass or dark glass or an old film negative. If you look at the sun through it, it will look like a round red circle.

All the stars that you see in the sky are also glowing gases. All stars give off their own light. The sun is the earth's special star.

The earth is not a star. It is a planet. It has no light of its own. It gets its heat and light from a star—the sun. Sunlight warms the soil. It helps plants to grow. Without sunlight plants and animals cannnot grow. We could not live without the sun.

What did you learn ?

The sun is the nearest star to the earth, The sun is made of hot burning gases which make it glow.

The earth has no light and heat of its own. It is the sun which gives us heat and light.

Without the sun's light, plants and animals could not live and grow.

Things to do

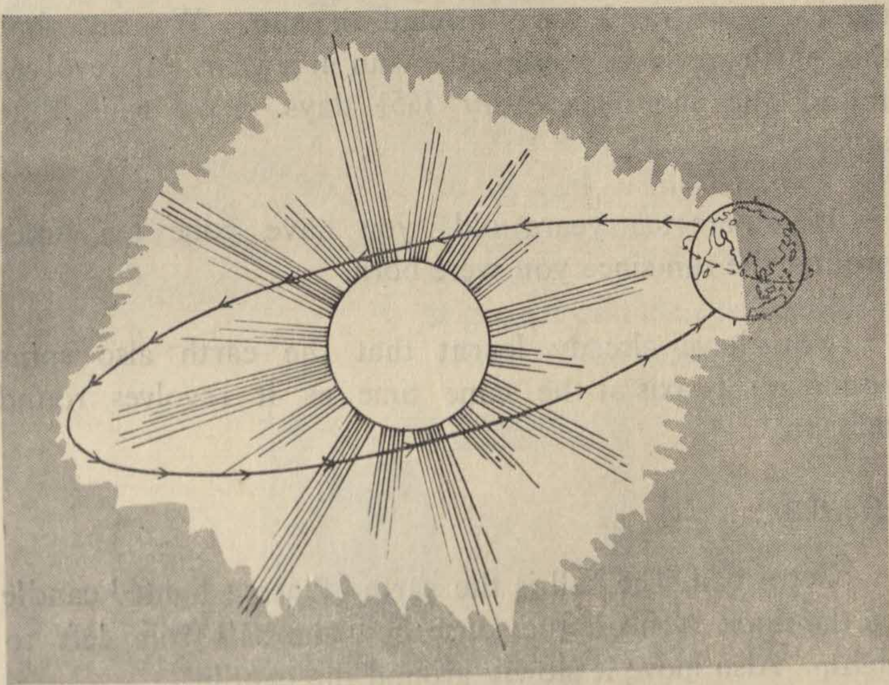
Look around you and see what are some of the things that you do now which you could not have done without the sun.

Questions to answer

1. Why is the sun called our special star ?
2. How is the sun important to us ?
3. What is the sun made of ?
4. What makes the sun glow so bright ?

21. How Seasons Change

Do you know that you are travelling round and round all the time ? Even when you are in your classroom, studying about the sun, you are moving along.



You are riding on the earth and the earth is travelling around the sun. Whether you are walking home or sleeping or playing, you are still making your journey without stopping for a minute. The earth is taking you on a long long trip. As you travel with the earth around the sun, you see different sides of the sun. They all look the same from this distance.

The road along which the earth travels round the sun is a very long one. It is almost a circle, and the sun is the centre of this circle. The earth travels very fast, but it takes 365¼ days to complete one trip round the sun.

We measure our year by the length of time it takes the earth to travel once around the sun. We say that the earth revolves round the sun in a year. It revolves round the sun once every 365¼ days. We call that a year.

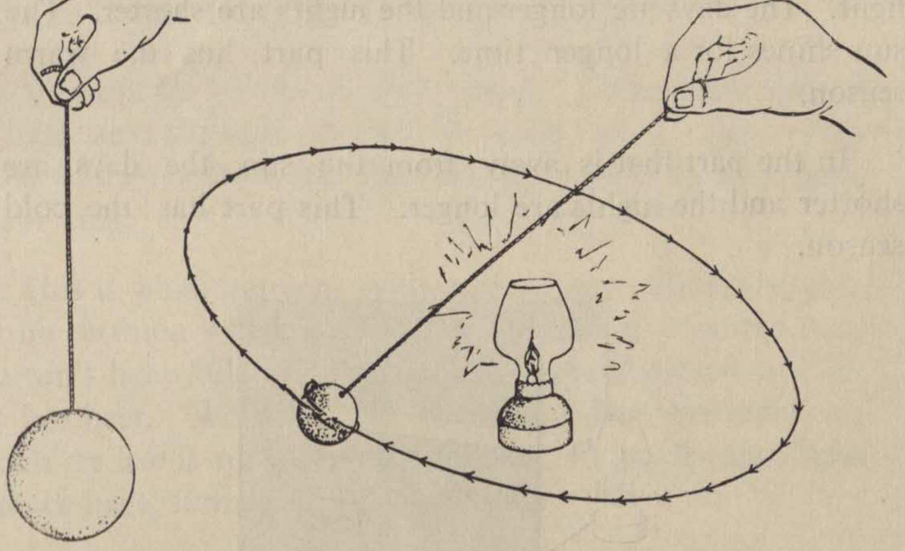
If you are ten years old, you have gone ten times around the sun since you were born.

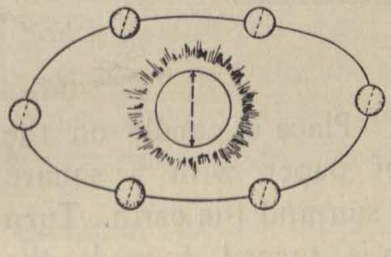
You have already learnt that the earth also spins round on its axis at the same time as it revolves round the sun.

Do this

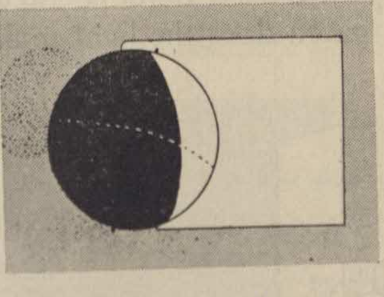
Get a ball. The ball is the earth. Place a lighted candle on the floor. This is the sun. Spin the ball from left to right. Also move it slowly around the candle.

The earth moves in two ways. It runs on its axis. It revolves round the sun.





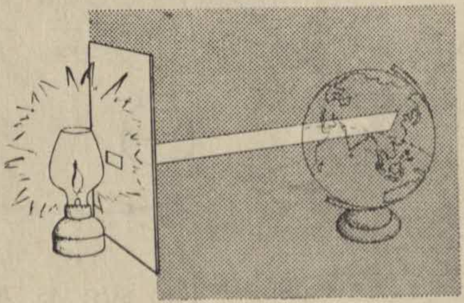
The sun is also spinning on its axis. But the axis of the earth does not point in the same way as the sun. As it goes round the sun it always points in the same direction.



For part of the year, the northern part of the earth is tilted towards the sun and for the other part of the year, the southern part is tilted towards the sun.

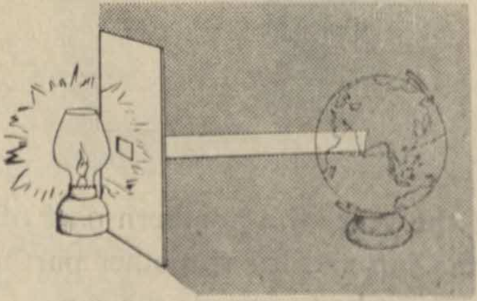
The part that is turned towards the sun gets more sunlight. The days are longer and the nights are shorter. The sun shines for a longer time. This part has the warm season.

In the part that is away from the sun, the days are shorter and the nights are longer. This part has the cold season.



Do this

Place a globe in a dark room. Place a candle on the floor for the sun. Take a piece of paper with a square hole in it and hold it between the sun and the earth. Turn the globe in such a way that India is turned towards the sun. How big a patch does the light make on India ?



Now turn the globe around so that India is away from the sun. How big is the patch of light now ?

When is the patch of light bigger ? The same amount of light went through the hole in both cases. But when India was away from the sun, the light spread out over a wider area.

This is what happens with sun's light. When the part of the earth on which we live is turned away from the sun, the sun's light falls at an angle. Its light is spread and we get less heat. We have our winter. When the part on which we live is tilted towards the sun, we get stronger light and we have summer.

An imaginary line half way between the North Pole and the South Pole of the earth is called the equator. People who live far away from the equator have the most changing seasons. Those who live near the equator have seasons which are not widely different.

Changing seasons affect the lives of the people, plants and animals. Can you tell what changes you observe in the life around you in summer and winter?

What did you learn ?

The earth spins on its own axis once in twenty-four hours.

The earth's rotation on its axis causes night and day.

The earth also revolves round the sun. It takes 365¼ days to complete one round. This is called a year. The earth is tilted on its axis. The revolution of the tilted earth causes the seasons to change.

Things to do

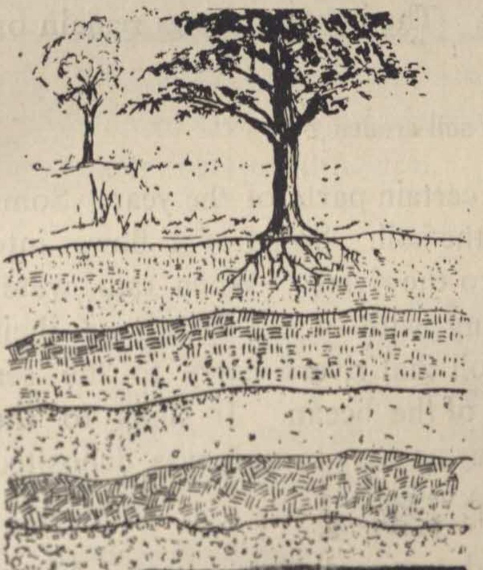
1. Cut and paste pictures to show how habits of boys and girls change in summer and winter.
2. Note down how long the day and night are on the 25th of December. Note down again how long the day and night are on the 25th of June. What difference do you notice ?

Questions to answer

1. You have learnt that the earth takes 365¼ days to go around the sun. Can you now explain what we mean by the leap year ?
2. How are seasons formed ?

22. *The Soil*

Have you seen people digging a well ? Or have you seen persons boring into the earth to set up a water pump? As the men dig deeper into the ground, they pass many layers of earth. Not all places in the earth are the same, but let us take one example of what we may find when a well is being dug. On the surface, one can see, many plants grow. The old leaves from the plants drop down beneath them and gradually form a layer of decayed leaves. In course of time the soil gets mixed with dead leaves, plant roots and other kinds of plant and animal matter. We call this soil loam. It is easy to dig up this upper layer of the soil because it is soft and loose. Below this is a layer of clay where the digging becomes more difficult. This layer is generally yellow in colour. Digging still deeper, you



come to a layer of sand. Water is usually found at the base of this sandy layer.

Digging further, you reach solid or loose rock. You can show the different layers in this way.

Do this

Take some decayed leaves, straw, sand, clay and little stones. Mix them together and put them in a large glass vessel full of water. Stir the contents well. Allow them to settle for ten minutes. What settles at the bottom ? What is the layer above it ? What is the next layer ? What is floating on the surface of the water ? How many layers do you find in your sample of earth ?

Rocks settle at the bottom because they are very heavy. The heaviest things settle down first at the bottom. Next come the less heavy things. The lightest things remain on the surface of the water.

How is soil eroded ?

It rains heavily during certain parts of the year. Some rain water is absorbed by the soil. Some of it flows into ditches and some flows into the rivers. When rain water flows, it carries soil along with it. Rivers pour their water into the sea. The soil that rivers carry to the sea is deposited at the bottom of the ocean. It sinks to the bottom in just the same way as your sample was deposited at the bottom of your glass vessel.

Day after day, more and more soil is deposited in layers at the bottom of the sea, Thus the rain water steals our soil and deposits it in the bottom of the sea. If we do not know how to save our fertile soil, the water will take it away from us and deposit it in the seas. Once soil reaches the sea, it is of no use to us. Our soil will become poor. To produce good crops, we must save our soil.

What did you learn ?

Soil is formed in layers.

Starting from the top, the layers of soil are loam, clay, sand and rocks.

In the process of soil formation, heavy things settle down at the bottom. The lightest things settle at the top.

Soil is gradually washed away by rain and the flow of rivers, if nothing is done to prevent it. The soil thus carried away is deposited at the bottom of the ocean.

We can save soil by growing trees and grass.

We can save soil by constructing bunds to prevent flood water from eroding soil.

Things to do

Fill a shallow pan or box with firmly packed soil. Set the pan outside in the rain with one end raised slightly. Observe how the rain drops splash the soil down towards the lower end. This will show you the effect of rain on sloping soil.

Questions to answer

1. Complete the following sentences :

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CALCUTTA-27

a. When soil is shaken with water . . . . settle first.

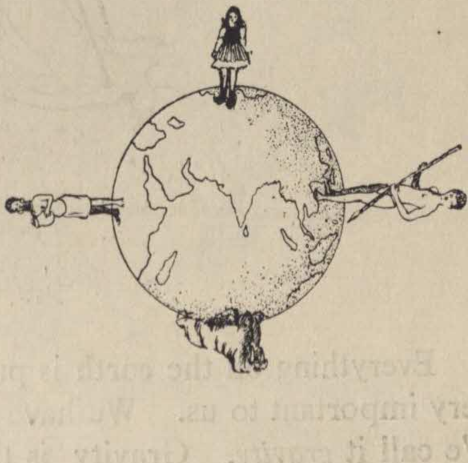
b. When soil is shaken with water, ... make the water muddy.

c. When soil is shaken with water, ... float on the surface of the water.

2. There is an open maidan in your neighbourhood. When wind blows hard, the dust from the maidan is blown by the wind and thrown into the houses. People in this locality find this uncomfortable. What should they do to prevent it ?

23. *The Big Pull of the Earth*

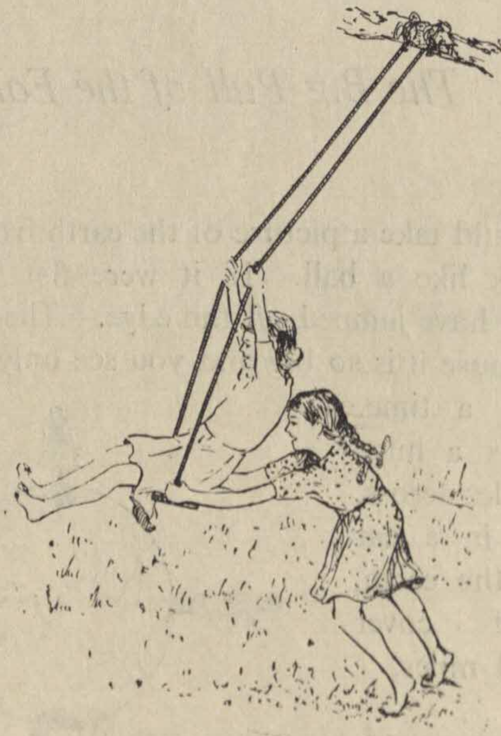
If you could take a picture of the earth from the moon, it would look like a ball. If it were flat like a table, people could have jumped off the edge. The earth looks flat only because it is so big and you see only a very small part of it at a time. The earth is a huge ball 8,000 miles across. If you drove in a car right round the earth, you would cover about 25,000 miles.



If the earth is round, why do we not fall off ? Let us see.

Walking up the stairs is hard work, but racing down the stairs is so easy. A man cycling up a hill bends over the handle bar and pedals hard. A man cycling downhill does not even have to pedal.

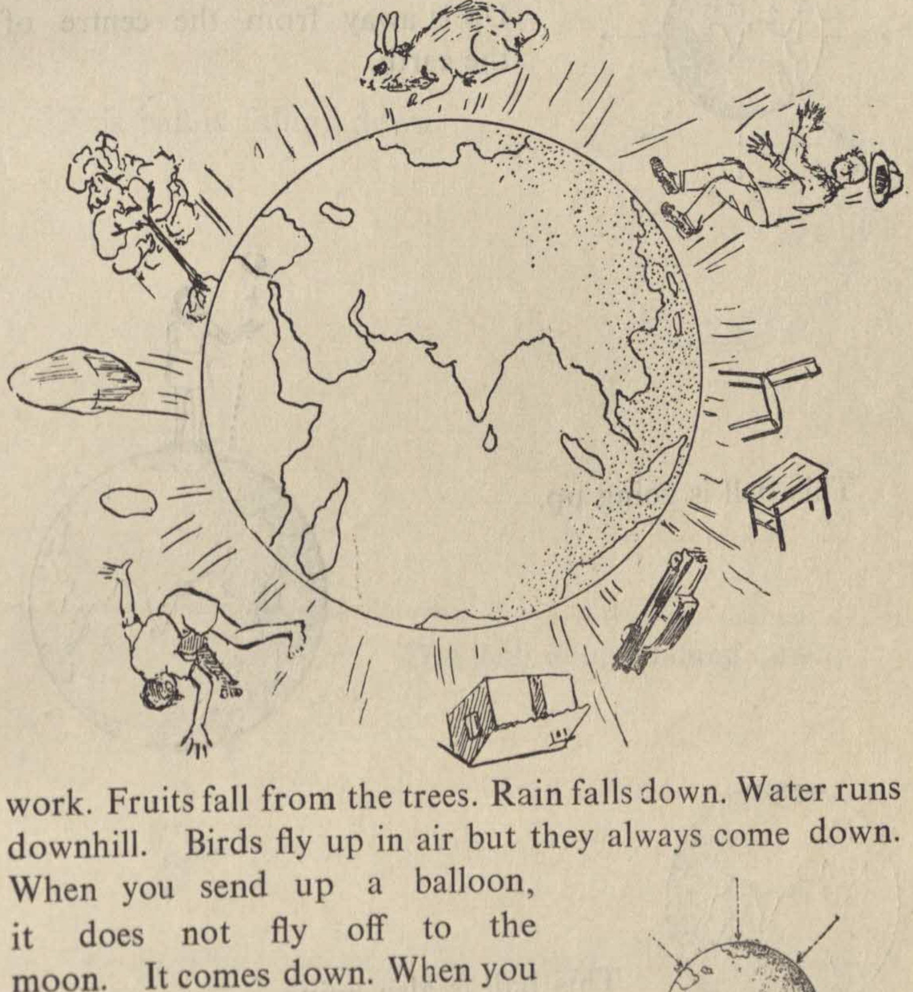
Have you played on the swing ? Your friend pushes you up on the swing. But you come down without being pushed. It is harder to carry things up than to carry things down. What helps you to move things down? What makes things that are thrown up into the air come down again?



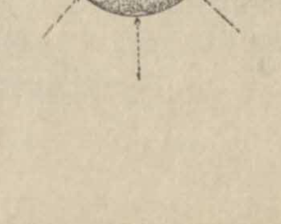
Everything on the earth is pulled down. This pull is very important to us. We have given a name to this pull. We call it *gravity*. Gravity is the pull of the earth on everything. Gravity holds everything to the ground.

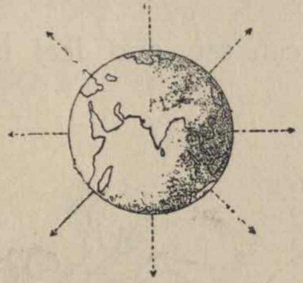
If gravity did not pull things down, it would be a very strange world. If the earth did not fasten things down, everything would go flying off into space. Your house would not stay where it is. When you came back home from school you would not find your house. But the earth does not play that trick on you. It holds your house and everything else down so hard that they stay where they are.

You cannot see gravity, but you can see and feel it



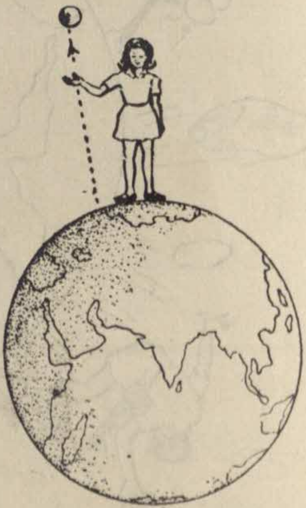
work. Fruits fall from the trees. Rain falls down. Water runs downhill. Birds fly up in air but they always come down. When you send up a balloon, it does not fly off to the moon. It comes down. When you trip on a stone, you fall *down*. You do not fall up. Gravity pulls everything down. Where is this *down* ? *Down* is towards the centre of the earth.

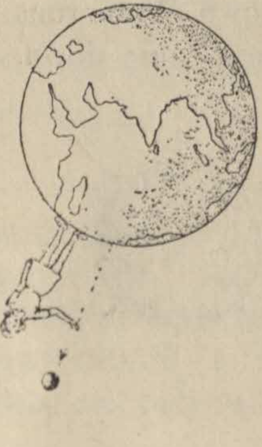




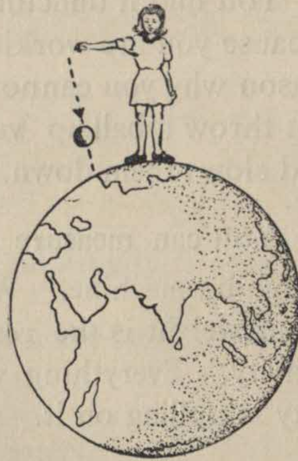
Up is away from the centre of the earth.

This ball is going up.

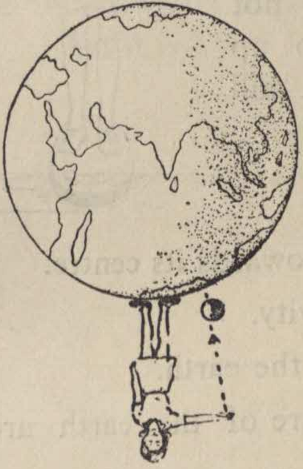




This ball is also going up.



This ball is falling down.



This ball is also falling down.

The girl's feet are down on the earth and her head is up in the air in both cases.

When things go away from the centre of the earth, we say 'They are going up'. When things go towards the centre of the earth, we say 'they are falling down'.

You find it difficult to go up or move things upwards because you are working against gravity. That is also the reason why you cannot jump very high and why you cannot throw a ball up very high. Gravity pulls on things and slows them down.

You can measure the pull of gravity. Stand on a weighing machine. What is your weight? Your weight is the result of the pull of gravity. Everything weighs because gravity is pulling on it.

If the earth had less gravity, everything would weigh less. You would not be pulled so hard. You could jump up more easily. You could climb up a hill easily, and could carry weights easily.

What did you learn ?

The earth pulls everything down towards its centre.

The pull of the earth is called gravity.

Gravity holds everything down to the earth.

Things that go away from the centre of the earth are said to go up.

Things that go towards the centre of the earth are said to go down.

The weight of things is caused by the pull of gravity.

Things to do

Make a list of all the things which you see falling because of the pull of gravity.

Questions to answer

1. Why do things fall down instead of going up ?
2. What is gravity ?
3. What would happen if there were no gravity ?
4. Why is it easier to carry a box down the steps than up the steps ?
5. How can you measure the pull of gravity ?
6. What would happen if the earth's gravity were half of what it is ?

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Dept. of Extension
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24. *How Heat Helps You*

You like to play in the sunshine in winter. The sunshine keeps you warm. The heat comes from the sun.

Heat is made by many things. The sun is a very important source of heat. The sun warms you, and it warms the earth. The warm earth warms the air, and you are warm too. How can you know that the sun keeps you warm ?

Do this

Take two thermometers that are of the same kind. Place one in the sunshine. Put the other one in the shade. What is the temperature in each place ? Why are the temperatures different ?

The thermometer in the sunshine shows a higher temperature than the thermometer in the shade.

When the day is cloudy or when it is night, the sun does not warm the earth. You dress in warm clothes in winter because there is less sunshine then. You sit before the fire. Fire helps you to keep warm. It gives off heat just as the sun does. The heat warms the air around you. Heat comes to you from the oven or the fireplace. What makes heat in the oven ? Coal burns to produce heat.

What burns to produce heat is called *fuel.* Firewood, charcoal, kerosene oil, are fuels. You burn something everytime you make a fire.

Look at the oven. Why is there such a big hole at the side ? Why do people keep the oven in the open yard or on the wall to help it light up ? Fuel must have air to burn. All ovens have openings to let air in. They also have some way to let the smoke out.

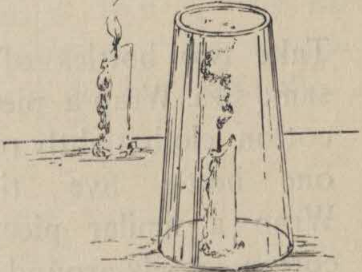
Do this

Gather a few dry sticks and dry leaves and set fire to them. Now take a handful of sand and put it on the fire.

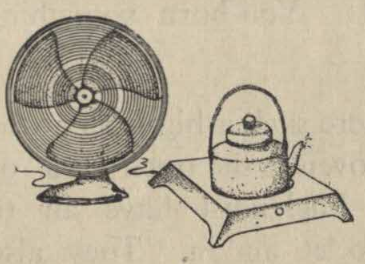
You find that the sand puts out the fire. Why does sand put out the fire ?

Do this also

Light a candle and fix it on a plate. Invert a tall glass tumbler over it.



The candle flame goes out. The glass shuts out the air. In the air there is a gas called oxygen which helps things to burn. When sand is poured over the fire, it shuts off the oxygen and the fire goes out.



Heat comes from electricity also. Electric heaters are used to warm homes. Electric ovens are used to give heat for cooking.

What happens when you run down the stairs passing your hand on the bannisters ? Your palm feels hot. Rub your hands together. See how warm they get. When two things rub together, heat is produced. The rubbing together of two things is called *friction*. Friction produces heat. Long long ago people had no matches. They rubbed two stones or sticks together to make heat.

Heat does many things for you. It keeps you warm. It cooks your food. It heats up the water for your bath. Think what life would be like if there were no heat.

How do you keep warm in winter ? You wear woollen clothes. Some people also wear fur. How does wool help to keep you warm ?

Do this

Take two bottles of the same size. Wrap a piece of cotton cloth tightly round one bottle five times. Wrap a similar piece of cotton loosely around the other bottle five times. Fill the bottles with hot water.

Close them with lids. which bottle stays warm longer ?

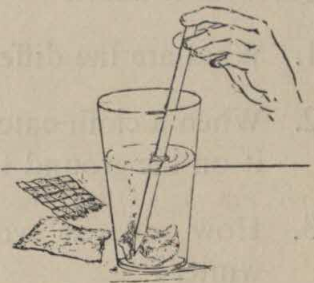
There is air between the layers of cloth in the second bottle. Air does not allow heat to pass through easily.

Let us find out if there is air in fur and wool.

Do this

Take a piece of fur or wool and push it into a glass of water. Hold it there with a pencil.

You will notice many air bubbles coming out of the piece. Try again with a cotton cloth.



There are not as many bubbles as with the wool. Fur and similar fluffy materials have plenty of air trapped among the hair. Your woollen garments have lots of trapped air which does not allow heat to pass through.

Your body is making heat all the time. The trapped air keeps the heat from getting lost. That is why furry clothes keep you warm. Cotton does not trap so much air. That is why cotton garments do not keep you as warm as wool.

What did you learn ?

The sun, fuels, electricity and friction produce heat.

Heat gives us warmth, cooks our food and is useful in many ways.

Woollen and furry garments keep us warm because they hold air between the hairs.

Things to do

1. Make a list of different fuels that are used to give heat.

2. Observe how boy scouts start a camp fire.

Questions to answer

1. What are the different ways in which heat can be got ?
2. When a cloth catches fire, people immediately stamp it on the ground to put out the flame. Why ?
3. How does a woollen garment keep you warm in winter ?

25. *How Tools Help You*

Can you lift a big stone ?

Can you break a log of wood ?

Can you pull a big nail out of the wall ?

You can do all of these things if you know how to use tools.

Let us see how.

Tools help you in lifting big weights

Take six bricks. Tie them together.

Try to lift them.

What do you find ?

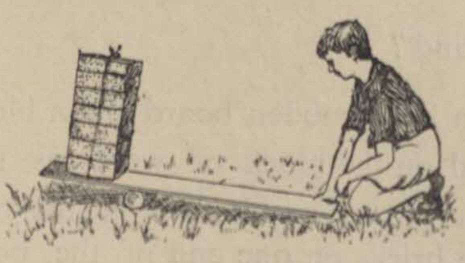
Now take a long wooden board and a block of wood. Place the board on the block of wood as shown in the picture on page 148. The block is in the middle of the board. Put the bricks on one end of the board with the help of your friend. Press the other end with your hands. Watch the bricks rise.

You saw that you could move the bricks easily by using the board and the block of wood.

You can lift the bricks easily by using the board and the block in a different way. How ? Try this.

Put the board on the wooden block so that the block is nearer to one end of the board as shown below in the figure. Put the bricks on the end nearer to the wooden block. Press the other end of the board.

What do you observe ?



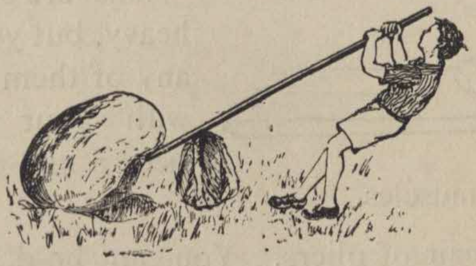
You saw that this time you could lift the bricks with less effort.

The block and the board are your tools, They can make your work easier and lighter.

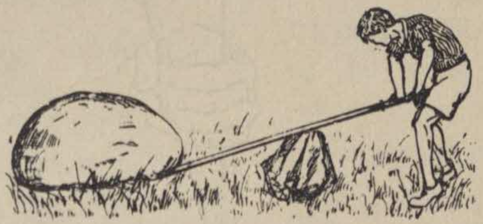
Do this

Here is a big stone to be pushed out of the way. It is too heavy for you to lift without help. Take an iron rod and a small stone. Can you use them to lift the stone ?

Place them like this. Does it work ?



Will this way work better ?

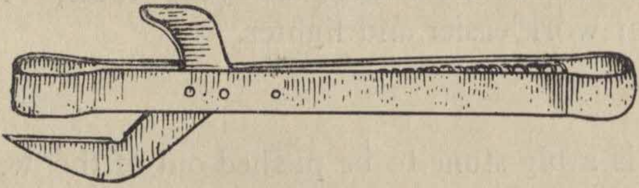


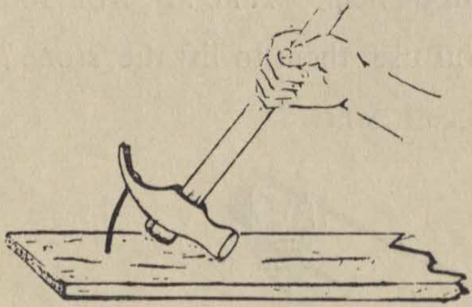
In which way do the iron rod and small stone help us to use our muscles ?

We call the iron rod a *lever*.

Other tools

Not all tools are long. The first tool shown on the next page is used to open the lid of a can.

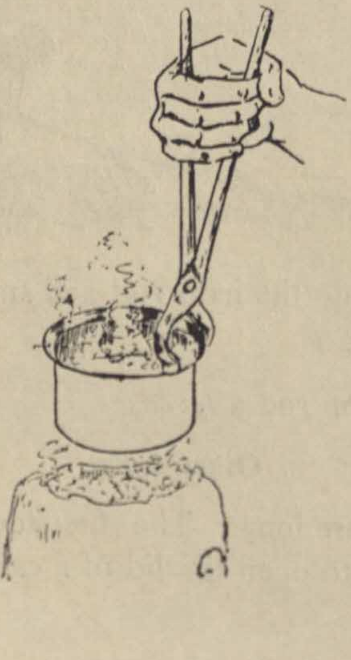




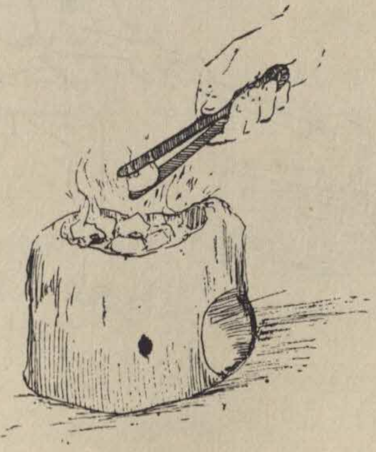
Not all tools are straight. This is a nail-puller. Its claw is curved.

Nails are sometimes not heavy, but you cannot pull any of them out of wood with your fingers. You need a nail-puller to help you use your muscles.

Here is a pair of pliers. You can hold a thing very firmly with them.



Here is a pair of tongs. You use it to hold hot things. You cannot hold very hot things with your hands.



Tools also help us to break things

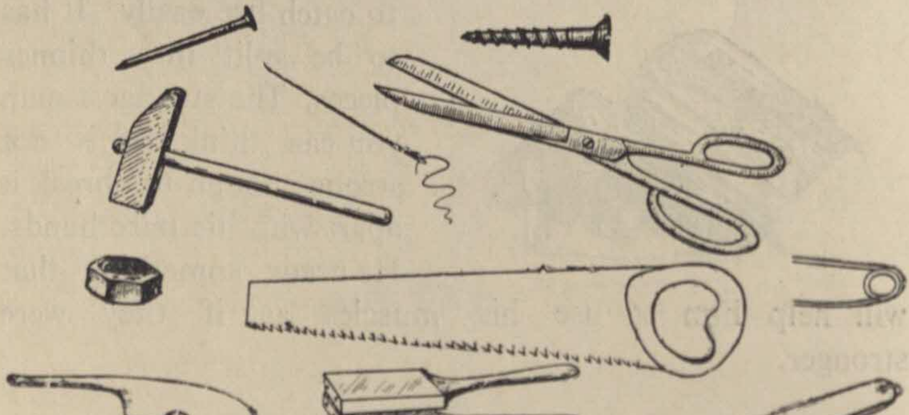
Here is a dry log for the fire. But it is much too thick to catch fire easily. It has to be split into thinner pieces. The strongest man you can think of is not strong enough to break it apart with his bare hands. He needs something that will help him to use his muscles as if they were stronger.

The first picture on the next page shows a man using an axe. The end of an axe is thin and sharp along one edge. It gets thicker toward the other edge. When you use an axe, your muscles are strong enough to split hard wood.

Do this

Here are pictures of some more tools.

When do you use them ? Name them.



Ask your parents to show you all these tools.

Remember

Use tools the right way. Ask people who know to show you how to use them. Each tool is made for a special purpose. Use the tools for these purposes only. Do not pull out nails with your knife.

Do not strike an iron nail with a pair of scissors. Use the tools carefully so that they do not hurt you. When you use a sharp tool, you must always use it in a direction away from yourself. You will then not be in danger of getting hurt. Put your tools back in place when not in use.

How to take care of iron tools in rainy season

Have you ever noticed that your knife gets a reddish brown coat in the rainy season ? This is rust. It spoils iron and steel tools.

To save your tools from rusting, coat them with oil or grease when they are not in use.

What did you learn ?

Tools help us to do things more easily and with much less effort than we do otherwise.

Some tools help us in lifting very heavy weights.

Some tools help us in holding things firmly.

Some tools help us in taking things apart.

Tools help us to use our muscles as if they were stronger.

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Each tool should be used for the purpose for which it is made.

Tools should be used in such a way that they do not hurt us.

Grease or oil should be applied to tools before the rainy season.

Things to do

1. List the common tools used in a home, a garden and a smith's shop.
2. Study the purpose for which each tool is used.
3. Using sticks, lift a table or a heavy box.

Questions for you

1. Complete the following sentences :

    a. We use a pair of scissors for . . . .

    b. To lift a heavy stone we can use a small stone and a . . . .

    c. A knife is used for . . . .

    d. A pair of tongs is used for . . . .

2. In column A, some tools are listed. In column B, their functions are listed in the wrong order. Rewrite them in the correct order.

Column A	**Column B**
1. Iron bar	to hold things strongly
2. Needle	to tear apart wood
3. Screw driver	to sew clothes
4. Axe	to unwind a screw
5. Nail puller	to lift heavy loads
6. Pair of tongs	to pull out nails.

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